

POPULAR SCIENCE

JUNE • 35c Monthly

Navy's New Undersea
**Hit-and-Run
Raider**



Preview of **U.S. Rear-Engine Small Cars** **PAGE 51**
7 New Ideas for Vacationing on Wheels **PAGE 138**
MECHANICS and HANDICRAFT SECTION **PAGE 125**

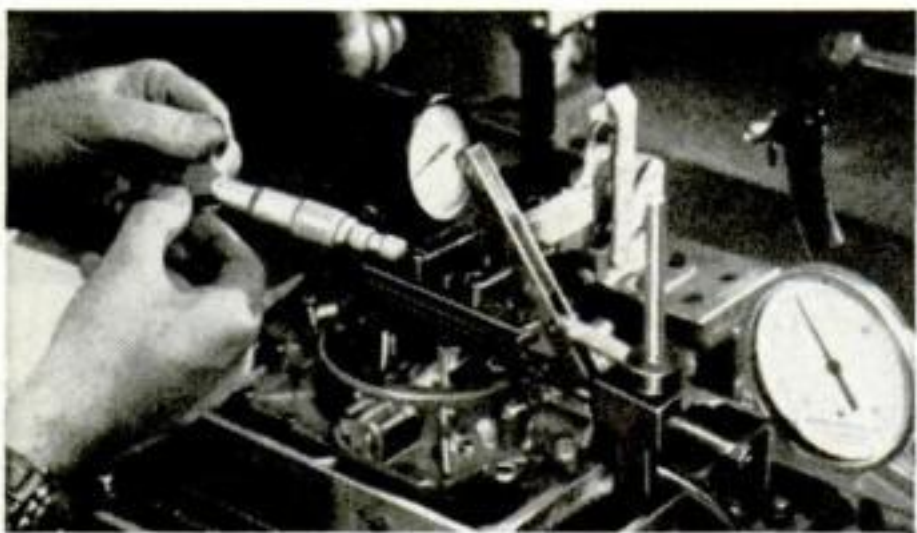
HOW **AMERICA'S NUMBER ONE CARBURETOR** SHAPES NEW-CAR PERFORMANCE AND STYLING!



Modern automotive styling calls for lower hood lines. This means Rochester-GM Carburetors must be designed to accommodate these changes and still perform their many jobs with accuracy and precision.



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Your Rochester-GM Carburetor must perform eighteen separate functions, such as providing vacuum for power equipment, in addition to its vital job of metering fuel. This means the carburetor must be designed and researched to meet today's many engine requirements. In addition, Rochester-GM Carburetor design leads the way to lower hood lines and today's smart styling. Such a complex and important part of your performance system requires skilled maintenance. That's why it's always wise to take your car to a Rochester-GM Carburetor specialist for periodic care. He's factory-trained in servicing your carburetor to give peak performance and economy. See him today.
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number one
original equipment
carburetors

REWARD

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PHILLIES. CHEROOT

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What's more, pardner, these

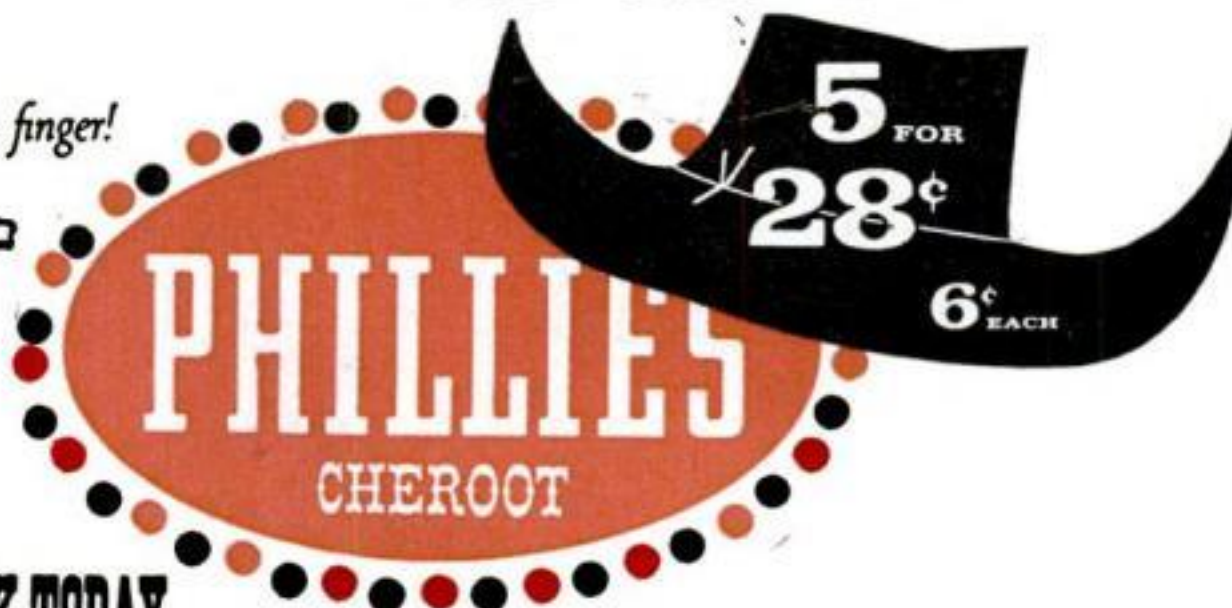


are **MIRACLE MILD**

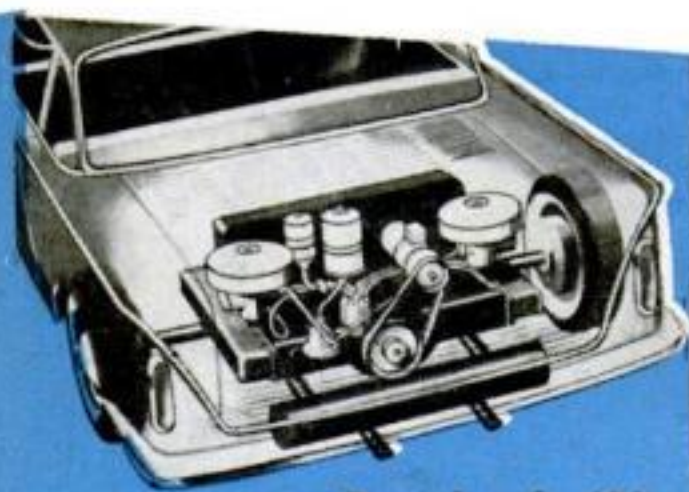
Why these cigars are as smooth and light as the sun settin' over the hills.

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YOU CARRY AWAY THE HANDY FRESH
PACK OF 5 FOR 28 CENTS!**

*Slick on the draw
and big as your trigger finger!*



PICK UP A FRESH PACK TODAY



Pancakes for '60
PAGE 51

Shoes as big as rowboats?
PAGE 134



That blood in your eye
PAGE 99

Founded in 1872 Vol. 174 No. 6

Mechanics and Handicraft REG. U. S. PAT. OFF.

Popular Science

June, 1959

Cover painting by Bob McCall

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Danger...
high voltage!
PAGE 66

They deal from the bottom
PAGE 94

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*America's Leading New-Idea
Magazine for 87 Years*

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PS Readers

TALK BACK



Helpful Tabs

YOU'VE a nice idea there in those new little thumb-index labels on the outside edges of your Table of Contents pages.

I often turn to back issues in search of a remembered article when a problem comes up. As my stack of PS is constantly growing, the tabs will help make the search easier. The illustration strip is an advantage, too. One picture is sure worth 1,000 words when you're tracking down a hazy memory.

T. E. ADKINS, St. Louis.

Popular Science Wins National Safety Award for Ninth Year in Row



NATIONAL SAFETY COUNCIL

425 NO. MICHIGAN AVE.
CHICAGO 11, ILLINOIS

April 8, 1959

Mr. Howard Allaway
Editor
Popular Science Monthly
355 Lexington Avenue
New York 17, New York

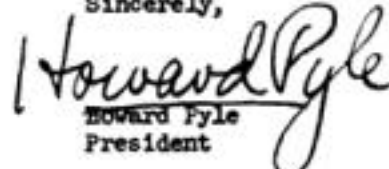
Dear Mr. Allaway:

It is my pleasure to inform you that your organization has been voted the National Safety Council's Public Interest Award for 1958.

We here at the Council know all you have been doing for safety and we are delighted that the judges agreed.

I am sure you feel, as we do, that there is another dividend as a result of your safety efforts -- the knowledge that you have helped prevent many accidents.

Many thanks for your support.

Sincerely,

Howard Pyle
President

HP:A
Enclosure

4 POPULAR SCIENCE

Good Idea Gets Lost

SEVERAL years ago [Mar. '54] you ran an article on an electromagnetic dry clutch which, if installed on stock models in the factory, would have revolutionized the automobile industry's and the consumer's concepts of transmissions.

I'm still waiting. What happened to what seemed to be a good thing for the consumer?

H. M. ISBELL, Bellevue, Ia.

We've been wondering, too. Detroit is closemouthed about such things, but we have learned that at least one of the Big Three tested it extensively with largely favorable conclusions, though raising questions about durability in severe service. Commented one engineer, after pleading for anonymity, "Besides, we had just completed a plant tooled for hydraulic transmissions."

Timing with Ping

THE economy quiz for car owners [Mar.] advises against advancing the spark and listening for ping or knock to



time an engine. I've been using this method since I started working on cars.

Many times when I use factory specifications, customers complain of sluggish motors and poor mileage. Then I set the timing till ping is heard, and follow this up by retarding it till only slight ping is heard on very heavy acceleration—regardless of insulation under hood and firewall, too.

I agree too much ping means holes in pistons, worn bearings, etc., but if you

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Building Maintenance
Carpenter-Builder
Carpenter Foreman
Carpentry & Millwork
House Planning
Lumber Dealer
Mason Foreman
Painting Contractor
Reading Arch. Blueprints
Reading Struct. Blueprints

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Commercial Art
Commercial Cartooning
Fashion Illustrating
Figure Drawing & Painting
Magazine Illustrating
Show Card & Sign Prod'n
Show Card Writing
Sign Painting & Designing
Sketching & Painting

AUTOMOTIVE
Auto Engine Tune-up
Automobile
Automobile Body Rebuilding and Refinishing
Automobile Electrical Technician

Automobile Technician
Diesel Engines
Diesel-Gas Motor Vehicle Engines
Gas Engines
Internal Combustion Engines

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Aircraft Mechanic
Aviation Engine Mechanic
Reading Aircraft Blueprints

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Retail Merchandising
Shorthand
Stenographic
Typewriting

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Chemical Engineering Unit Operation
Chemical Laboratory Technician
Chemical Prod'n Foreman
Elements of Nuclear Energy
General Chemistry
Industrial Analytical Chemistry
Industrial Chemistry
Paper Making
Professional Engineer—Chemical
Pulp & Paper Engineering

Pulp & Paper Making
Pulp Making

CIVIL ENGINEERING
Bridge & Building Foreman
Civil Engineering
Construction Engineering
Highway Engineering
Mine Surveying & Mapping
Principles of Mapping
Principles of Surveying
Professional Engineer—Civil
Railroad Engineering
Roadmaster
Sanitary Engineering
Section Foreman
Sewage Plant Operator
Structural Engineering
Surveying and Mapping
Water Works Operator

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Architectural Drafting
Drafting & Machine Design
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Electrical Engineer Drafting
Industrial Piping Drafting
Junior Mechanical Drafting
Mechanical Drafting
Sheet Metal Drafting
Structural Drafting

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Electrical Eng'r (Power Plant option—Electronic option)
Electrical Engineering Tech.
Electrical Instruments
Electric Light & Power
Electric Motor Repairman
Electrical Operating Eng'r
Hydroelectric Power Plant Equipment
Industrial Electrical Eng'r
Lighting Technician
Power-House Electric
Practical Electrician
Practical Lineman
Principles of Steam-Electric Power Plants
Professional Engineer—Electrical
Reading Electrical Blueprints

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Good English

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High School College Prep (Engineering & Science)
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Short Story Writing

LEADERSHIP
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Industrial Supervision
Personnel-Labor Relations
Supervision

MECHANICAL
Industrial Engineering
Industrial Instrumentation
Junior Mechanical Engineer
Mathematics and Mechanics for Engineers
Mechanical Engineering
Professional Engineer—Mechanical
Quality Control

PETROLEUM
Natural Gas Production & Transmission
Oil Field Technology
Petroleum Production
Petroleum Prod'n Eng'r
Petroleum Refinery Operator
Petroleum Refining
Petroleum Technology

PLASTICS
Plastics Production Foreman
Plastics Technician

PLUMBING, HEATING, AIR CONDITIONING
Air Conditioning
Air Conditioning with Draw'g
Air Conditioning Maintenance
Domestic Heating with Oil & Gas
Domestic Refrigeration
Heating
Heating & Air Conditioning
Heating Drawing & Estimat'g
Plumbing
Plumbing Drawing & Estimating
Plumbing & Heating
Plumbing & Steamfitting

Practical Plumbing
Refrigeration
Refrigeration & Air Conditioning
Steamfitting

RAILROAD
Air Brake Equipment
Car Inspector & Air Brake Diesel Electrician
Diesel Engineer & Fireman
Diesel Locomotive
Diesel Machinist
Railroad Administration
Railroad Car Repairer

SALESMANSHIP
Creative Salesmanship
Marketing
Real Estate Salesmanship
Retail Salesmanship
Sales Management
Salesmanship
Salesmanship & Sales Management

SHOP PRACTICE
Boilermaking
Electric Welding
Forging
Foundry Practice
Gas and Electric Welding
Gas Welding
Heat Treatment of Metals
Industrial Metallurgy
Inspection and Physical Testing of Metals
Machine Shop Inspection
Machine Shop Practice
Machine Shop Practice & Toolmaking
Metallurgical Engineering Technology
Practical Millwrighting
Reading Shop Blueprints
Resistance Welding Technology
Rigging
Safety Eng'n'g Technology
Sheet Metal Worker
Tool Designing
Tool Engineering Technology
Toolmaking
Welding Engineering Technology

STEAM AND DIESEL POWER
Combustion Engineering
Power Plant Engineering

Stationary Building Eng'r'g
Stationary Diesel Eng'r'g
Stationary Diesel-Electric Engineering
Stationary Fireman
Stationary Steam Eng'r'g
Steam Engine Operation

TEXTILES
Carding and Spinning Supervisor
Carding Technician
Cotton Manufacturing
Cotton Warping & Weaving Supervisor
Cotton Warping & Weaving Technician
Hosiery and Circular Knitting Loom Fixing Supervisor
Loom Fixing Technician
Spinning Technician
Synthetic Fabric Manufacturing
Synthetic Fabric Warping & Weaving
Synthetic Yarn Throwing & Warping
Textile Designing
Textile Engineering
Textile Finishing & Dyeing Supervisor
Textile Finishing & Dyeing Technician
Textile Mill Supervisor
Woolen Manufacturing
Worsted Manufacturing

TRAFFIC
Motor Traffic Management
Railroad Rate Clerk
Traffic Management

TV-RADIO-ELECTRONICS
Gen'l Electronics Technician
Industrial Electronics
Practical Radio-TV Eng'r'g
Radio Operating
Radio Servicing
Radio Servicing with Practical Training
Radio & TV Servicing
Radio & TV Servicing with Practical Training
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JUNE 1959 5

know what you're doing, I don't think you can hurt an engine. I'd sure like to hear what other mechanics have to say.

F. G. BEZEK, Lockport, N. Y.

That Perfect Connection

PUTTING mercury into the terminals of a car's distributor cap will cause amalgamation with the brass, as letter writer G. E. Lemmon says [May]. To provide a perfect connection between high-tension spark-plug wires and the terminals of the distributor cap: Clean out the terminal holes with a piece of steel wool on the end of a slotted dowel.

R. R. LAKSO, Midland, Mich.

Have Sled, Will Travel

I REALLY enjoyed "The Snowplane: Blizzard on Skis" [Feb.] as I've just built a sled for the sheriff of our county for winter patrol of Lake Minnetonka and the surrounding area. It will be mounted on a pontoon boat to serve as a rescue craft in summer.

I have built two of these sleds on wheels—the only sleds licensed to be driven on Minnesota highways. Con-

structed of aircraft tubing covered with an aluminum skin, they ride on 10-inch aircraft wheels. An 85-hp. Continental



engine provides enough power for 85 m.p.h. on land; better over snow and ice. Skis racked under the back of the sled can be attached to the wheels in seconds.

P. J. FUCHS, Avon, Minn.

Good Roadkeeping

WE HAVE been using a roadside trash receiver similar to the one Mr. Bryant wants ["I'd Like to See," Mar.] at Esso stations in New England.

We have also encouraged our dealers

Stop at the sign of the Smiling Tire



Tire meets chuckhole—that's when you need Smileage

Real punishment—but you can relax on B.F. Goodrich Silvertowns. We do the worrying for you in torture tests more brutal than any chuckhole. Forget tire worries. Make driving fun again on the quality tires automakers put on new cars. Get Smileage! 4 tires, \$4 down.

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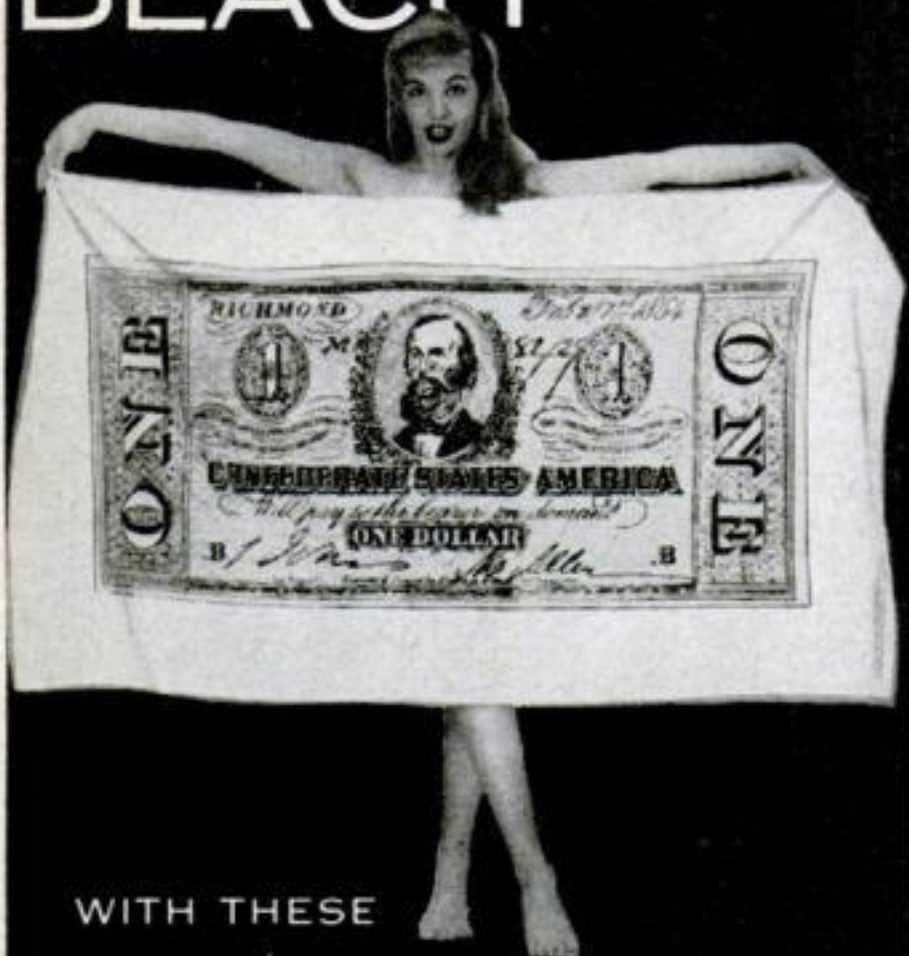
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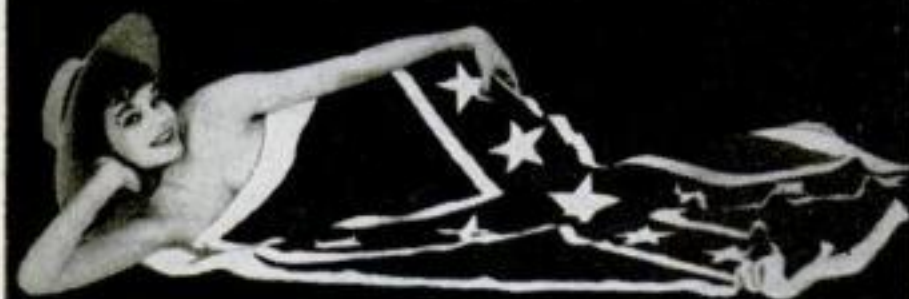
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to give out trash bags. This has not met with enthusiastic response from the public, nor from dealers. However, we keep encouraging this effort.

J. A. MILLER

Retail Sales Mgr.

Esso Standard Oil Co., NYC.

Why Dads Get Gray

You really pulled a funny in "Have You Heard?" [Mar.] when you asked if Junior's math is looking weirder than usual lately. Man and boy, I've used "guesstimated" division for some 30 years, so it can't be new.

I have two boys who bring home math homework (7th grade, 1st-year high) that I definitely can't dig. It isn't that I



can't solve the problems—I can prove it by the back-of-the-book answers. But those two kids of mine keep saying, "That isn't how our teacher tells us to do it." Then they lay out a tortuous modus operandi that takes them an hour and 44 minutes to achieve the same result. In the process I feel like a frustrated rat in a maze concocted by a psychopathic psychologist.

EDWIN A. CHRIST, PH. D.

University of South Dakota
Vermillion, S. D.

Aluminum and Magnetism

A MAGNET will not attract aluminum. Yet in "Revolution in Magnets" [Mar.], writing of magnetic bearings in electric meters, you say: "The spinning aluminum disk floats in air, its support an invisible magnetic field induced by a magnet that never touches it."

GEORGE SOULE, Bradford, R.I.

Aluminum is nonmagnetic. However, when an aluminum—or any metal—disk cuts a magnetic field, an electric current (called an eddy current) is generated in the disk. This current creates its own

I WAS STANDING STILL IN A FAST-MOVING WORLD!



① MANY OF MY NEIGHBORS WERE MAKING BIG MONEY... AND BUYING NICE HOMES IN THE SUBURBS...



② ... BUT I STILL WORKED ON AN ASSEMBLY LINE... EARNING THE SAME PAY... AFRAID OF A LAYOFF

I TRIED LOOKING FOR A BETTER JOB... BUT NO EMPLOYER WANTED AN UNTRAINED MAN

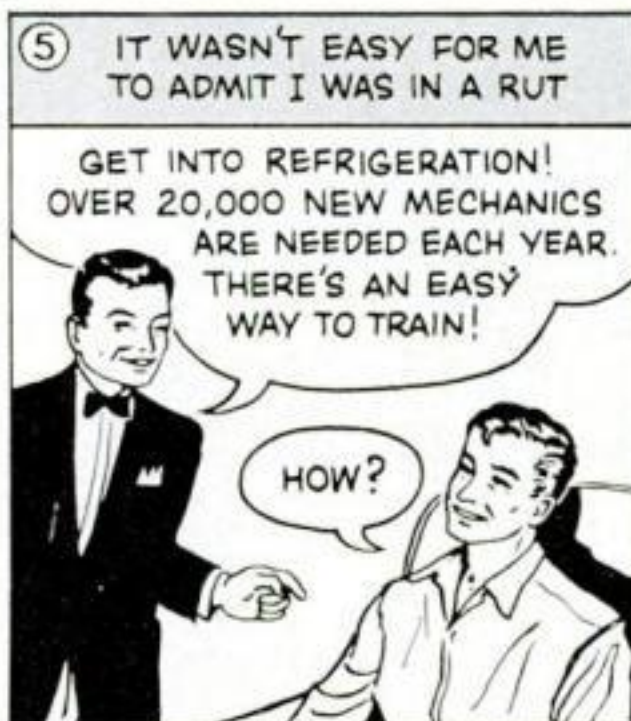


③ I SWALLOWED MY PRIDE WHEN MY WIFE RETURNED TO HER OLD JOB BECAUSE WE NEEDED MONEY



④ ONE DAY A PAL DROPPED IN... HE LOOKED PROSPEROUS

I OWN A REFRIGERATION AND AIR CONDITIONING BUSINESS. WHAT'S YOUR LINE?



⑤ IT WASN'T EASY FOR ME TO ADMIT I WAS IN A RUT

GET INTO REFRIGERATION! OVER 20,000 NEW MECHANICS ARE NEEDED EACH YEAR. THERE'S AN EASY WAY TO TRAIN!

HOW?



⑥ THE NEXT DAY MY FRIEND SHOWED ME HOW HE LEARNED THIS SECURE, HIGH-PAY CRAFT...

YES, I LEARNED QUICKLY BY PRACTICING AT HOME... C.T.I. SENT ME 25 KITS TO BUILD THIS REAL CONDENSING UNIT... TOOLS TOO! I ALSO MADE MONEY AS I TRAINED!



⑦ THAT NIGHT, I MAILED A COUPON FROM A C.T.I. AD FOR FULL INFORMATION



⑧ SOON I WAS TRAINING WITH REAL OPERATING EQUIPMENT DOING FIELD-TYPE PROJECTS

YOU'RE LEARNING FAST!



⑨ IN A FEW MONTHS I WAS READY FOR A GOOD JOB WITH A BRIGHT FUTURE

CAN YOU START MONDAY?



⑩ MY BIG PAY LETS US LIVE A LOT BETTER... MY FAMILY IS MORE SECURE... THANKS TO C.T.I.!

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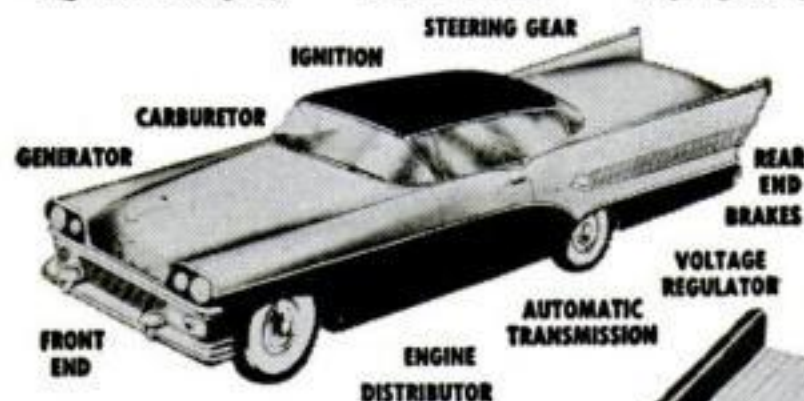
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magnetic field and the reaction between the outside magnetic field and the eddy-current magnetic field floats the disk.

Good Words for Wordless Project

OUR very active 18-month-old daughter would pull any chair in the house into the bathroom to wash her hands or get a drink. You can imagine our delight when we saw the perfect "chair" for her in your March "Wordless Workshop."

My husband made the step-stool for her in a matter of hours and we snapped this picture of her in action.

MRS. N. NAVARRA, Greensburg, Ind.



Small Cars: Winter Wonders?

THAT fellow in March "PS Readers Talk Back" who boasts he "had fun looking for buried small cars" never does say he found any. Good reason why: They had long since gone while he was skidding around on the light rear end of his glorified truck.

We have more hills than he has in Rome, N. Y.; also lots of small cars, but I've yet to see one stuck. And the owners save money by not buying snow tires.

W. F. WILKINSON, Attica, N. Y.

... In Idaho, I've given U. S. cars (a new model every two years) a pretty good test in snow. If Mr. King's car can go where my little Simca can go, it is a new breed of Chevy.

P. W. TIFT, Plummer, Idaho.

... In Minnesota—out where winter was invented—I'll take my MG every time. I detour to another street if faced with an icy hill when in my Hudson.

S. R. REAMER, New Brighton, Minn.

... In Nebraska, on the country road we live on, there's lots of mud and deep snow. Neither my husband nor I has ever been stuck in our Crosley.

MRS. E. D. CHURCH, So. Sioux City.

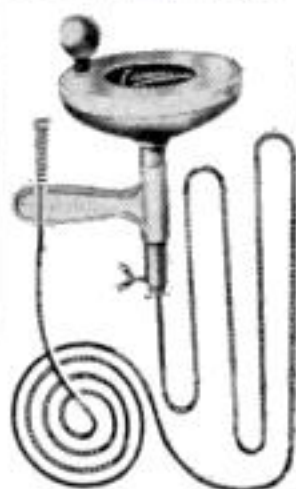
... In Oregon, where we lived last year, I drove over Grants Pass in my VW without a slip—but I got a dented fender

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\$4.95

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7x35

Orig. 24.95 **9⁹⁸**

COATED lenses, power without distortion or color breakdown. Made of cast metal with pebble grain Jet

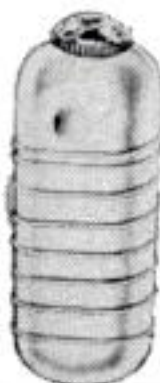
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3⁸⁸



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7⁹⁵



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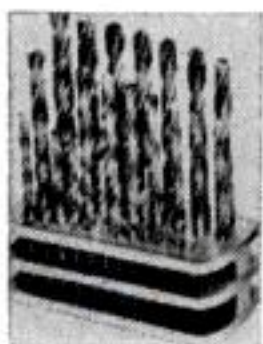
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from a Detroit car sliding backward down the hill.

TOM ELLS, Concord, Cal.

... In Texas, we had no trouble with our little Fiat 600 in the deepest snow.

J. R. GLOVER, Canyon, Tex.

... In Wisconsin, my trusty Volkswagen took me through ice and snow while dozens of big cars were being towed.

GERALD KLEVENOW, Pewaukee, Wis.

PS a Good Investment

THE best investment I ever made was my subscription to your magazine. I needed some new handsaws, but didn't know what ones to purchase. As always, POPULAR SCIENCE came to the rescue with "Choosing the Right Handsaws" [Dec.]. I now have a dandy selection of these tools but little expert knowledge of how to use them. How about a Know-How File on the subject?

J. V. YUDIS, Chicago.

Octopus Not So Phony?

YOU'RE wrong: "Nature's Phony Villain" [Mar.] is not so phony. Anyone in-

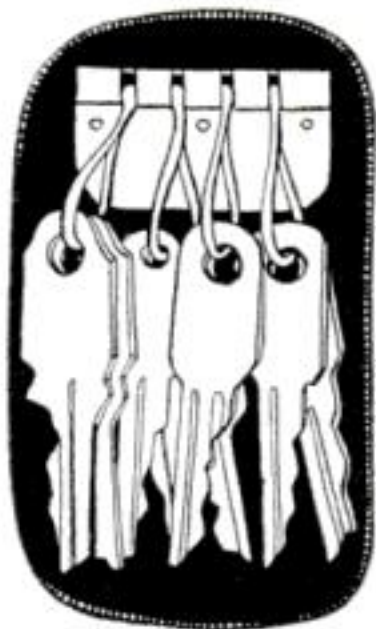
terested in the subject should look up Lieut. Harry E. Reisberg's book, *I Dive for Treasure*. On rare occasions, inside sunken ships he has found gear punched full of holes by full-grown octopuses.

They have a big beak like a parrot's, and are timid only while too young and small to attack anything large. Once they reach giant size, they'll attack anything—even sharks.

JOHN KATONAK, Lorain, Ohio

Key to Key Carrying

I'D LIKE to share with fellow readers one of the most significant developments since the invention of the wheel: a revolutionary method of sawing and filing the heads of keys so that eight will fit nicely into a case made for four. Let the Russians try and top this!



CHARLES FISHER, Detroit.

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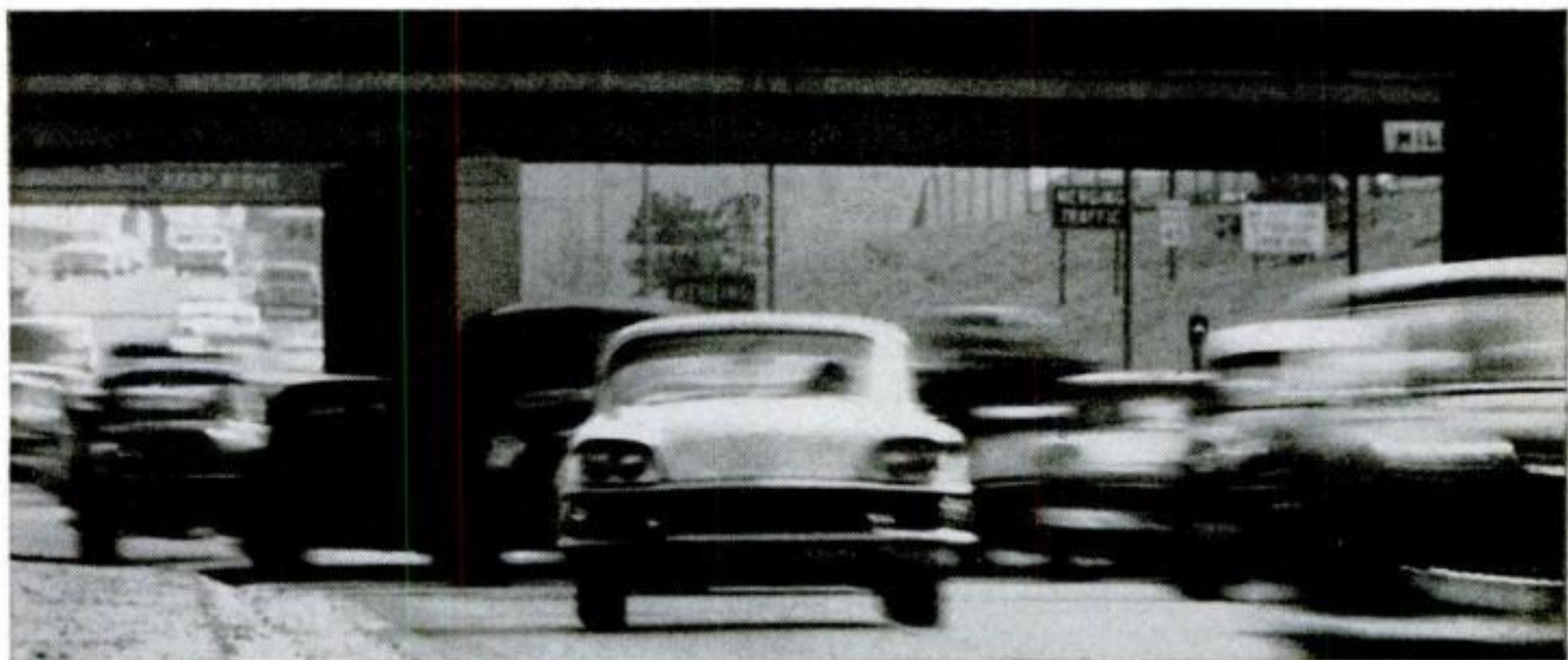
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*Firestone Rubber-X is compounded specifically for each type of car, truck, farm implement and construction equipment tire.



Jim Rathmann says:
"On the throughway,
as well as on the speed-
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longest wearing tires
that money can buy—
Firestones!"

Firestone

BETTER RUBBER FROM START TO FINISH

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Have you heard...?

Two drinks are too many if you're going to drive. That's what a staff of doctors conclude in an American Medical Association report on driver fitness. The key question is how much alcohol gets into the blood stream. If it reaches a level of .035 percent, driving performance is impaired: Judgment, observation, tolerance to glare, sense of caution are affected.



Okay



Dangerous



Too much!

Why? Alcohol acts as a depressant, not a stimulant. The false lift you get comes through depressing inhibitory mechanisms. The cocky self-assurance means critical sense has been gagged.

One drink won't hurt. Two (two ounces of 100-proof whisky or two 12-ounce bottles of 3.2-percent beer) downed in an hour put you in the danger zone with more than .035 percent alcohol in the blood. Three push it up to .05 percent—too much.

How long does it take to reduce the level once you've stopped drinking? The average person burns up and eliminates 1/3 fluid ounce of alcohol an hour. That cuts saturation by .015 percent. So it takes about two hours for two drinks to wear off. Part of the alcohol is exhaled through the lungs. That's why police use breath-testing machines. The concentration of alcohol in breath is directly proportional to the amount in the blood as it circulates through the lungs—roughly a 2,100:1 ratio.

The doctors stress that it doesn't matter whether the alcohol in the blood at any given time is following an increasing or decreasing curve of intoxication. They also debunk the importance of the form in which it was drunk, whether it was on a full or empty stomach, whether the person has a "high tolerance" or not. All that matters is the concentration in the blood and the consequent effect on driving.

Sobering statistics prefaced the AMA study. Last year an estimated 15,000 Americans died in car accidents involving a drinking driver—about half the total number of car fatalities.

The better life (automatic division) is coming closer. New products on, or coming on, the market will help you snap better photographs, shave closer, keep a neater lawn, breathe easier, and ride softer. Here's the rundown:



- Cheaper automatic cameras. Now you can get an electric-eye camera—that's the kind that adjusts its own lens aperture for light—for as little as \$35. Kodak's Brownie Starmatic even warns you when there's not enough light and locks the shutter until things brighten up. Other shutter-bug developments: Revere promises an attachment fitted with baby flashbulbs that give as much light as ones four times as big. They'll be loaded on a clip, like cartridges. Fire one and the next automatically falls into place. Faster color film will be in camera stores this month: a new 35-mm. Ektachrome with an ASA rating of 160. For professionals, a zoom-type lens [PS, May] made by a West German firm, Voigtlander, will list for about \$300. Similar to television cameras, the "zoom" extends a lens of normal focal length like a telescope into a telephoto one.

- A closer shave. A razor that allows you to adjust the blade at



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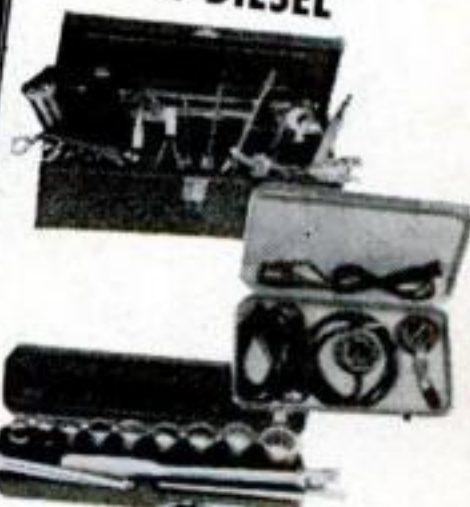
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Have you heard...?

nine different angles is brand-new in the stores (timed for Father's Day). Peering closely into bathroom mirrors, Gillette researchers decided that the angle's the thing that determines the closeness of the shave. Price for the razor: \$2.



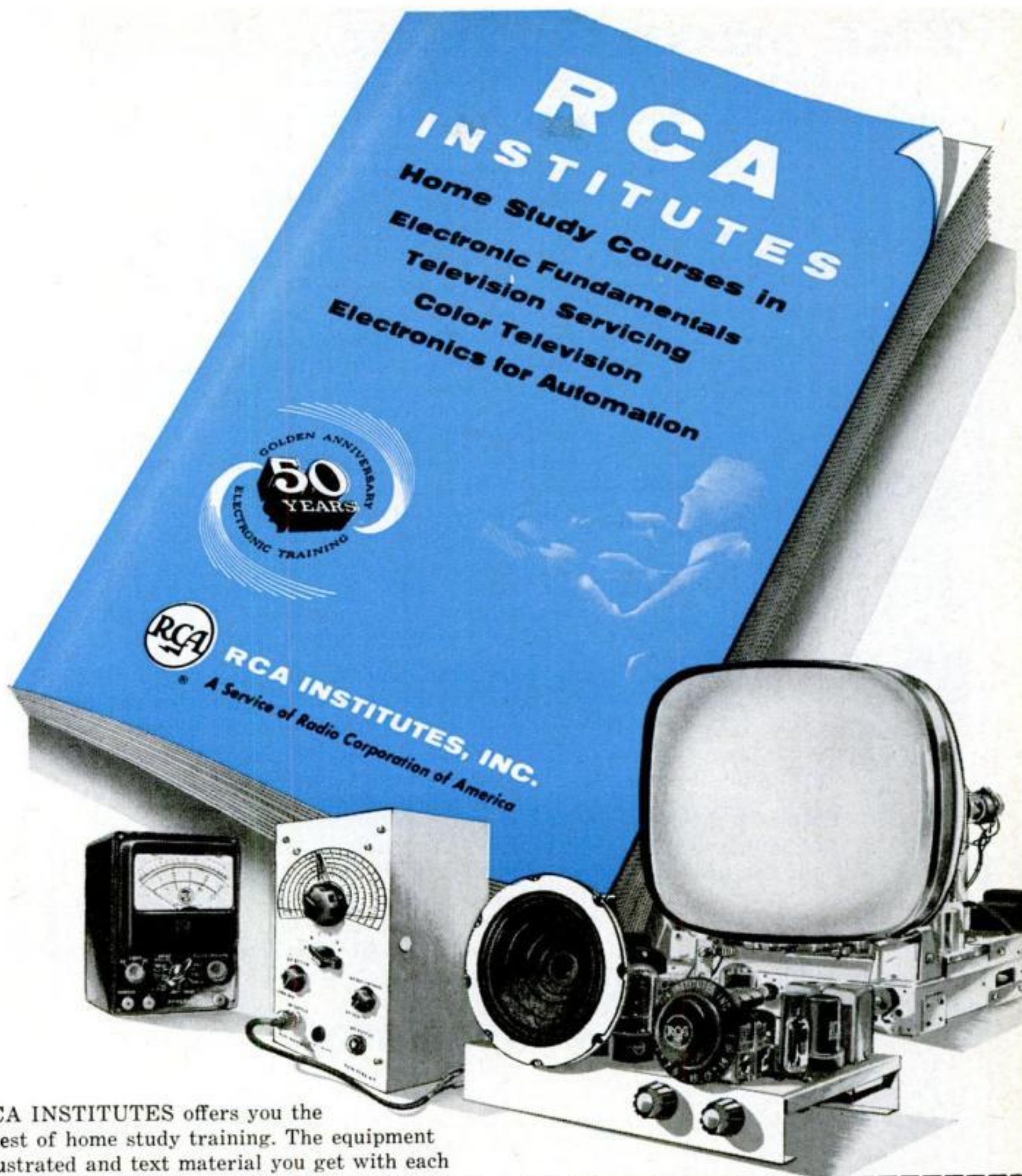
- And maybe no shave at all for the lawn. Department of Agriculture scientists are getting close to a grass-stunting chemical that may mean a once- or twice-a-summer mowing job. They've got one now that works on plants. Apply it to Easter lilies and they "come to a screaming halt." The name alone may stun them: It's 2-4 dichlorobenzyltributyl-phosphonium chloride. The stuff will be marketed under the name of "phosfon-d" by Virginia-Carolina Chemical Corp. Originally planned as a weed-killer, it mererly dwarfed its victims when added to the soil. Dosage is tricky, though. Too stiff and the leaves bunch up and shrink. Too light and it perversely stimulates growth. Researchers assume it affects the plant's nourishment-regulating enzymes; don't quite know how it works.
- Smog-proof gasoline: Where else but in Los Angeles? Tidewater has a new mix it says cuts down the number of hydrocarbons released from the exhaust into the air. Competitive oil companies say it's just the normal warm-weather formula.
- Aluminum car wheels may be on some '60 models, says Kaiser Aluminum. And while they ponder aluminum applications to driving comfort, Goodyear announces a new tire synthetic, "Plioprene," supposed to ride softer, quieter, more vibration-free. It's a result of rearranging the molecular structure of existing synthetics to produce a "luxury-ride" tire like the experimentally tested tires of butyl rubber.

Saner speed laws? They're beginning to appear on the books in many states. California led off, raising the speed limit from 55 to 65 on open roads. Wyoming, Colorado, Arizona, Iowa are among some 20 others with legislation pending that will up limits to 70. Some also aim to establish lower limits to spur slowpoke drivers. In New York, traffic engineers have begun an extensive study looking toward new laws. They're clocking drivers along major roads to see just how fast most people drive. Using radar speed meters, they'll collect data to establish new legal speeds. If they find that 85 percent of motorists travel at 50 m.p.h. along a highway posted for 40, they'll recommend upping the limit.



Traffic experts agree that unrealistic limits make for accidents because neither drivers nor police respect them—in turn encouraging disrespect of the law. As further ammunition they cite a study by the U. S. Bureau of Public Roads which showed:

- More accidents on high-grade roads in open country occurred at 35 m.p.h. than at any other speed.
- The greatest menace was the slowpoke driver. Second was the 80-m.p.h. speeder.
- The safest driving range: between 45 and 70 miles per hour. "Moderately high speeds," the study contended, "are associated with the lowest accident rates on highways properly engineered for accommodation of high speed."



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The month in science

Automatic checks bounce faster. Next year many of the checks you get and perhaps the ones you write are going to look different. They'll have a string of clumsy numbers, printed in magnetic ink, across the bottom. Machines will read them.

The magnetically coded checks clear the way for automation of the banking business. And just in time, too. Bankers are drowning in a sea of the pastel-colored slips of paper that people now use instead of money. The number of individual checks written is staggering: 10 billion last year. That divides up to 50 checks for each man, woman and child in the country. And the total grows by another billion a year.

The machines that read the new automatic checks work something like home tape recorders. Each has what corresponds to an erase head, a coil that magnetizes the printed code. The numbers are printed in iron-oxide ink which will hold magnetism for only a short while, so they are not made magnetic until just before they are to be read. The reading head on a check machine corresponds to the playback head on a tape deck. It recognizes the numbers by the strength of the signal each generates (the thickness of the printing determines this) and by the frequency of the signals (this depends on the shapes of the numerals).



Biggest benefit now of the magnetic numbers: far faster sorting. The first four digits (see sample check below) tell the bank's location; the next four identify the bank itself. This will help speed checks back through the clearing houses to your bank (the Federal Reserve Bank of New York clears 2,000,000 checks a day). The next 10 digits are your account number, for automatic sorting within your bank. This much of the code is "preprinted" on the blank check, just like the bank's name.

The amount (last 10 digits) is not coded on the check until it gets to the bank for payment, when a clerk does it on the same machine that performs the first sorting operation. A "transaction code" (the four digits before the amount), to separate checks, deposit slips and other papers, may also be added then—and your check is ready for a completely automatic trip through your bank's bookkeeping labyrinth, unseen and untouched by humans.



The magnetic number code won't change the way you make out your checks. Not yet, anyway. Eventually, though, you might have to use symbols and inks that the black boxes can read (there are ways you could do this without renting an IBM machine).

Automatic checks will discomfit some people, though. Faster clearing will give them less time to cover checks that they cash

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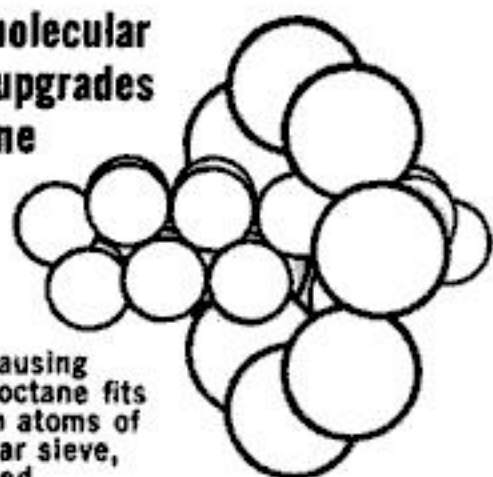
The month in science

out-of-town against insufficient funds in the home bank. More checks will bounce—and faster.

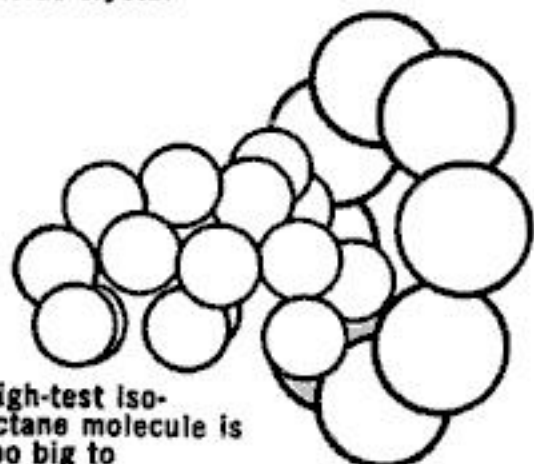
Molecular sieves strain knock out of your gasoline. The lab wizards have now come up with a real gasser of a chemical trick. It's a molecular sieve—crystals that literally work as strainers—to

How molecular sieve upgrades gasoline

Knock-causing normal octane fits between atoms of molecular sieve, is trapped inside crystal



High-test iso-octane molecule is too big to enter sieve



produce better gasoline cheaply. When you run raw gasoline through the sieve, these crystals strain out molecules that cause knock but let high-octane molecules pass. You get fuel that burns cleaner and smoother. It knocks less, and reduces rumble (because there's less need for "aromatic" mixtures that boost octane rating but may cause rumble).

Much of the research on molecular sieves has been done at Linde Co. (liquefied gases, synthetic sapphires), while Texaco and Universal Oil Products have put them to work refining gasoline. Universal (a patent lab which makes no gasoline) says that its Molex method will gush super premium with an octane rating of 105. Top commercial fuel is now 102.

The molecular sieves are honest-to-goodness sieves. They separate one material from another strictly on the basis of size,

just the way you grade gravel or sand. But in this case the mixture being graded is entirely liquid, and the particles are molecules, far too small to be seen with the most powerful microscope. The mesh of the molecular sieve is fine, indeed: about .000,000,02 inches (finer ones can be made). The strange crystals that make sieves are called zeolites, compounds of oxygen and silicon with sodium or calcium. Their atoms join into flat plates that link together to form hollow boxes. The flat-plate sides have holes in them—the spaces between atoms. That's the mesh of the sieve. Molecules small enough to go through the holes get trapped inside the boxes. Molecules too big to enter the holes just slide around the crystals and pour out of the pot. In the gasoline process, long and slim molecules—the low-octane "normal paraffins"—pass through the mesh and are trapped inside the crystals, while knobby, forked molecules—the high-octane "isoparaffins"—remain outside in the liquid stream.

One of the more fantastic things about these sieves is that the mesh is adjustable. If you heat the crystals, the atoms jump around faster (they're always moving) and open the holes bigger.

Science enlists fairies (baby-tooth division). Around St. Louis the good fairies who put dimes under children's pillows and take away newly lost first teeth are cooperating in a deadly serious research project. They send the teeth to the Greater St. Louis Citizens' Committee for Nuclear Information, which gauges the content of radioactive strontium 90 (from A-bomb fallout).

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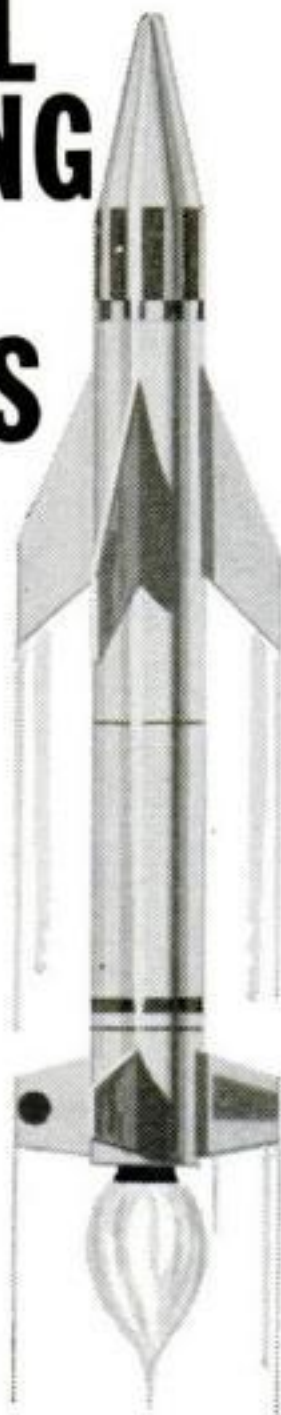
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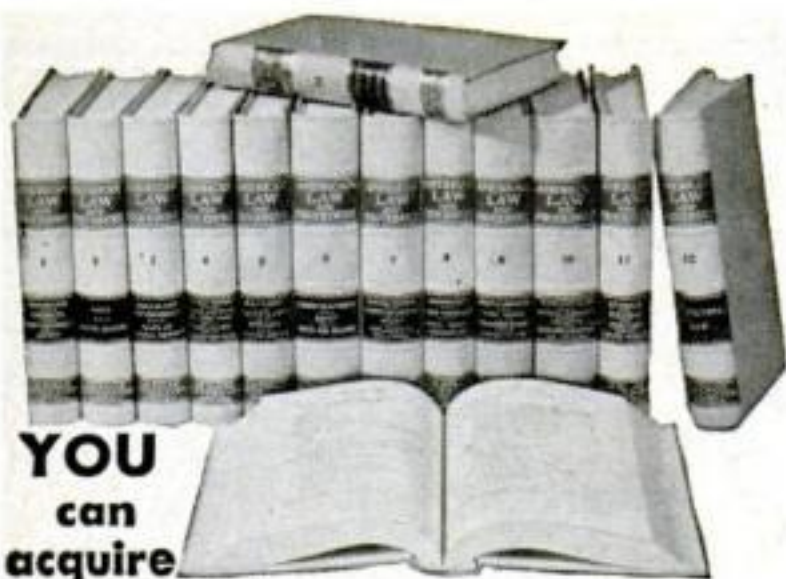
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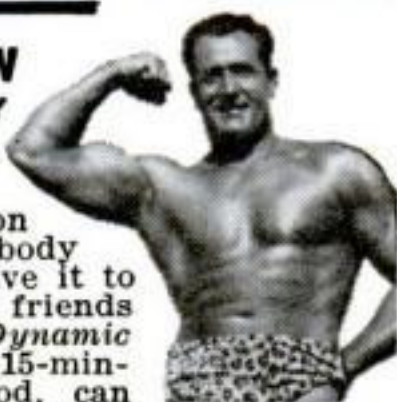
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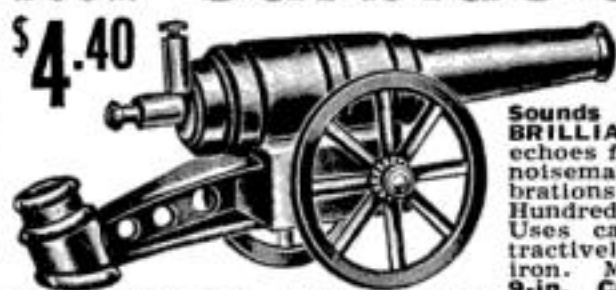
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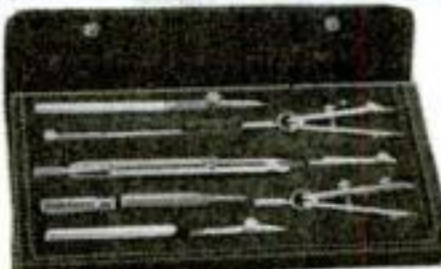
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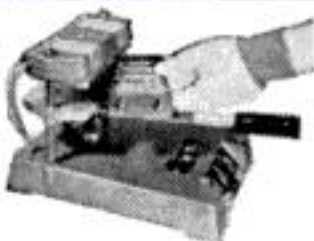


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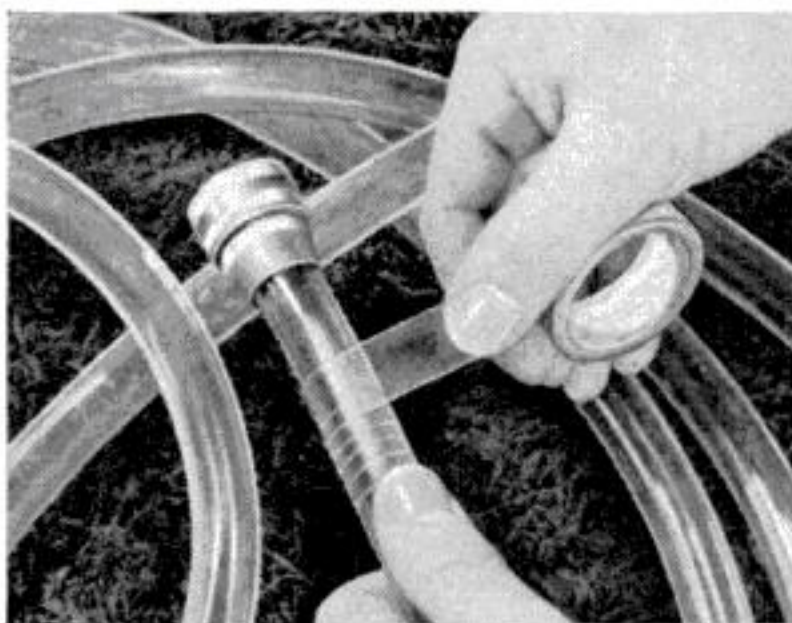
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U. S. Small Cars Coming Fast

Preparations for smaller cars built by the Big Three are picking up in tempo. Reports are that Ford's Buffalo stamping plant is readying the machinery that will be used to turn out body panels for FoMoCo's compact automobile.

Former motor-line area in Chrysler's Dodge main plant is being converted for that company's entry, the Valiant.

Work has been going on at Chevrolet's Willow Run truck plant, where the smart money says Chevy's smaller car will be built. Pilot production models of the opposed six-cylinder engine that will power it have already been built.

Ford's compact-car engine will be an in-line six with push-rod-operated overhead valves. It will have a displacement of about 140 or 145 cubic inches, a horsepower rating of 90 to 100. The engine is some 5½ inches lower in profile and six inches shorter than current Ford sixes. One unconventional idea: Though located up front, the engine will be tilted on its side, current Indianapolis racing-car practice, to permit low hood line.

Fortunate timing for American Motors brings up a comparatively extensive model changeover for Rambler this fall—just when it will be needed to combat Rambler-sized Big Three models.

Styling changes of the Ramblers and Ambassadors will be the most extensive since 1957, and there'll be some interesting engineering developments. Smaller Rambler American models will stand pat, with little change.

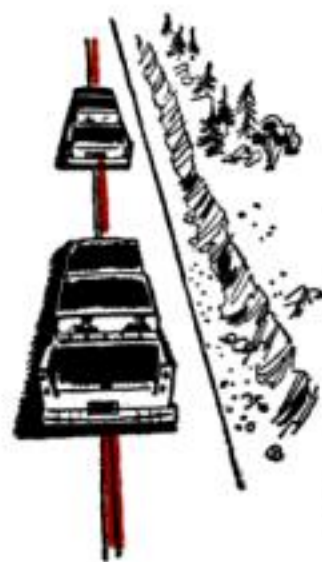
A \$250 radar system for automobiles, "more reliable and more practical than any suggested so far," has been developed by Westinghouse. Engineers claim it will be in experimental use within two years, in general use as early as 1964. Cars follow a strip of foil or special metallic paint down the highway. Antennas pick up a code from the strips, feed signals through the radar to electronic devices that correct speed and steering. It can indicate road conditions up to a mile ahead—in any weather, day or night.

Westinghouse says radar-reflecting material could easily be installed on roads by state highway departments. Strips could be laid either as adhesive-backed foil or as metallic paint using the same spray equipment now used to mark traffic lanes on highways.

Suggestion: Don't throw your steering wheel away just yet.

Electric cars will stage a comeback if companies now developing such vehicles have their way. In addition to the one developed by Stinson Aircraft in San Diego [PS, Feb.] another

[Continued on page 196]





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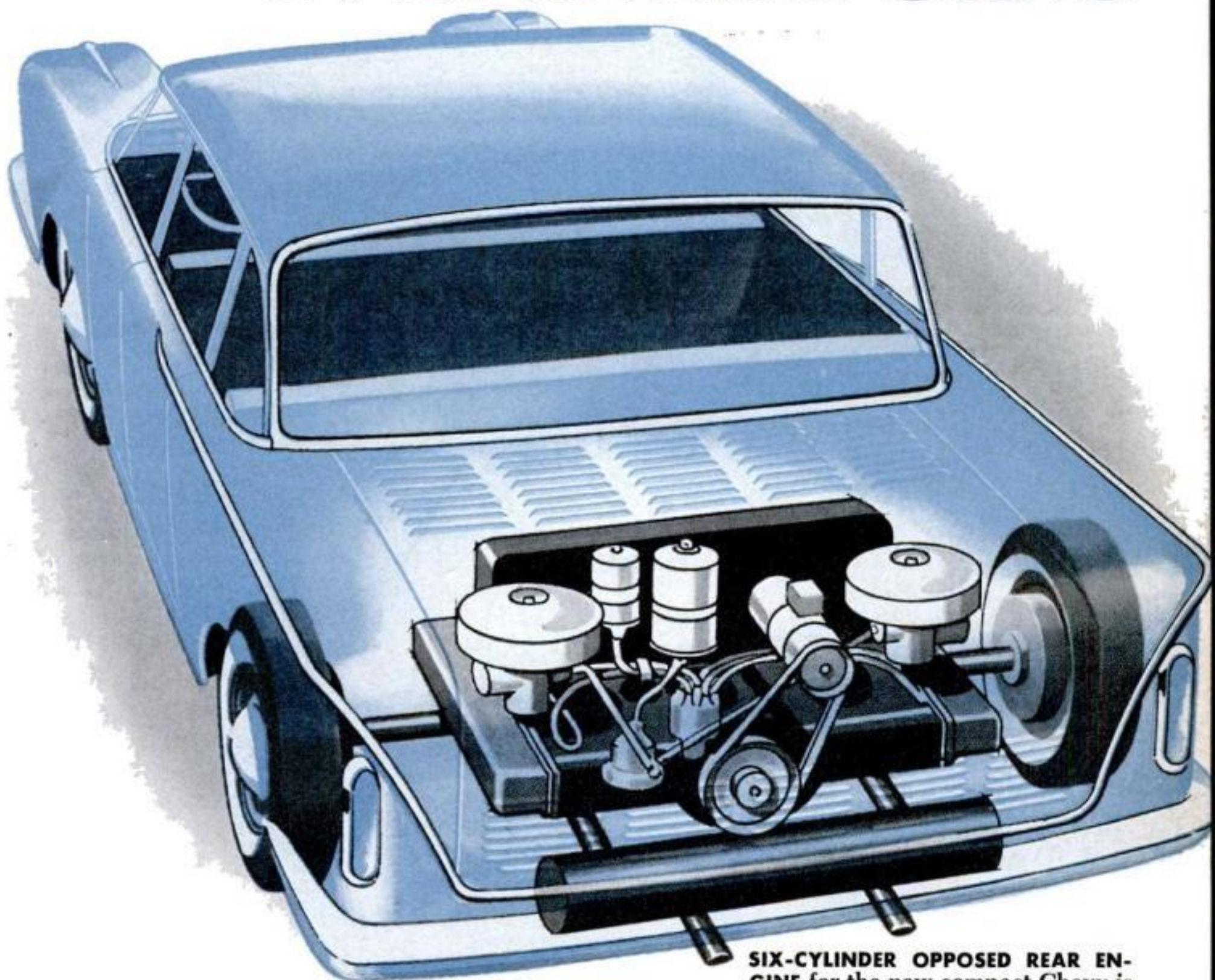
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Preview of the

Rear-Engine U. S. Small Cars



SIX-CYLINDER OPPOSED REAR ENGINE for the new compact Chevy is shown in artist's conception of what the car could look like when it's introduced later this year.

How about that rear engine? Here are the pros and cons, with a rundown of what you can expect this fall in GM's compact car

By Ken Fermoye

THE first mass-produced American car with an engine in the rear since the era of the curved-dash Olds is scheduled to appear this fall. It will be the new compact model now being tested

and prepared for introduction by Chevrolet.

Why has no U. S. manufacturer built a modern rear-engine car before now? And why has Chevrolet decided to develop such a vehicle at this time?

Putting a car's engine in the back

Rear-engine U. S. cars have been tried in the past . . . but



EXPERIMENTAL FORD CHASSIS with engine in rear was built in Dearborn about 1930, and scale-model bodies for it were tested in wind tunnel before project was abandoned.

makes sense in a lot of ways. Here are some of the most important:

- Low overall height is possible when there is no drive tunnel to take up passenger space. Floors can be flat.

- Engine weight on driving wheels makes for excellent traction.

- Steering is easy. Front wheels are lightly loaded, and less complicated steering gear is needed.

- Overall length and weight can be reduced and aerodynamic shape improved, for better performance and economy.

But there are problems. Among the more serious are these:

- Preponderance of weight at the rear

means such cars are basically oversteerers and are inclined to have disturbing handling qualities.

- Luggage space is usually scanty in comparison with front-engine cars.

- Passenger-compartment heating and engine cooling can be difficult.

- Control rods and cables are longer, more complicated than with front engines.

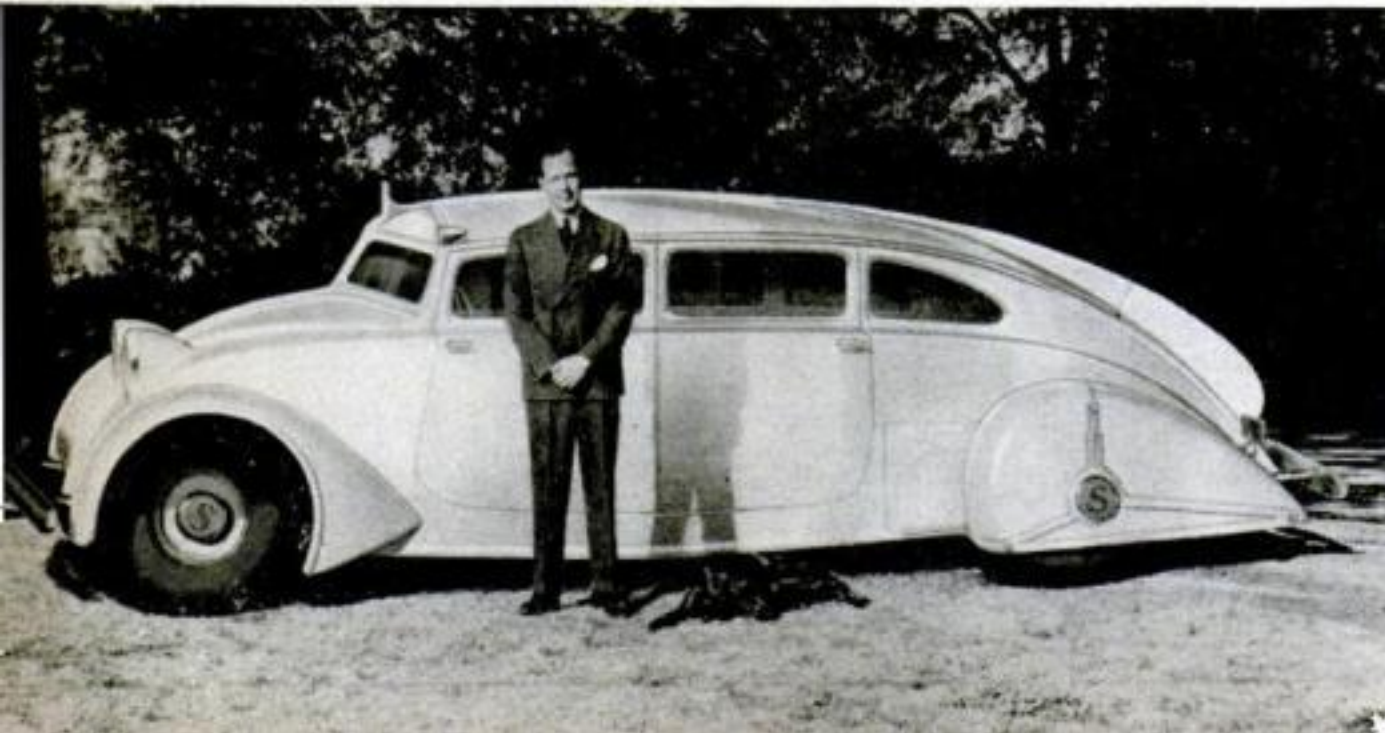
- Building various body styles of one model is difficult—station wagons, for example.

Some of these problems get increasingly knotty as car size increases—the reason rear-engine cars have been largely ignored in this country for years while achieving success in Europe where cars are smaller and lower powered.

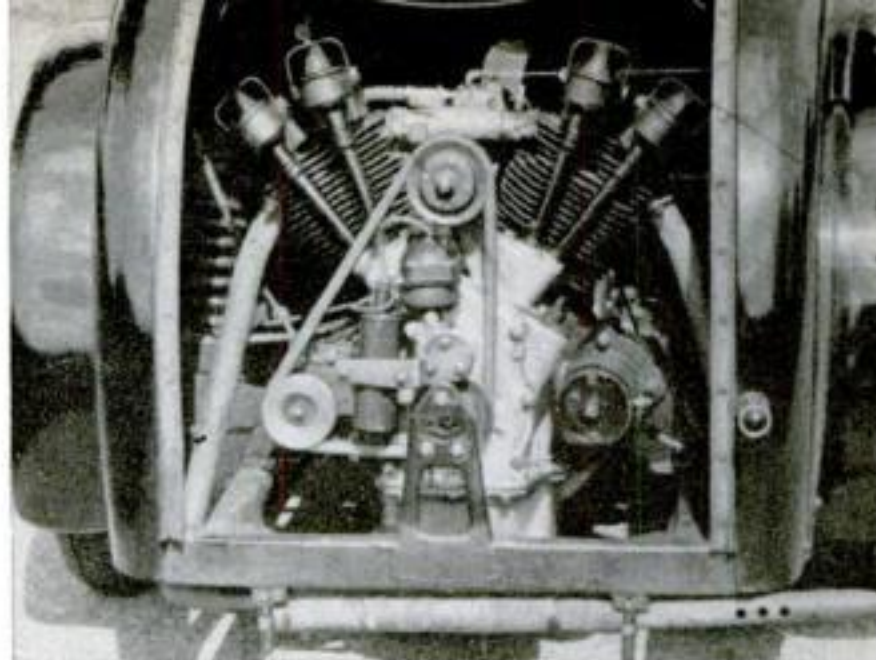
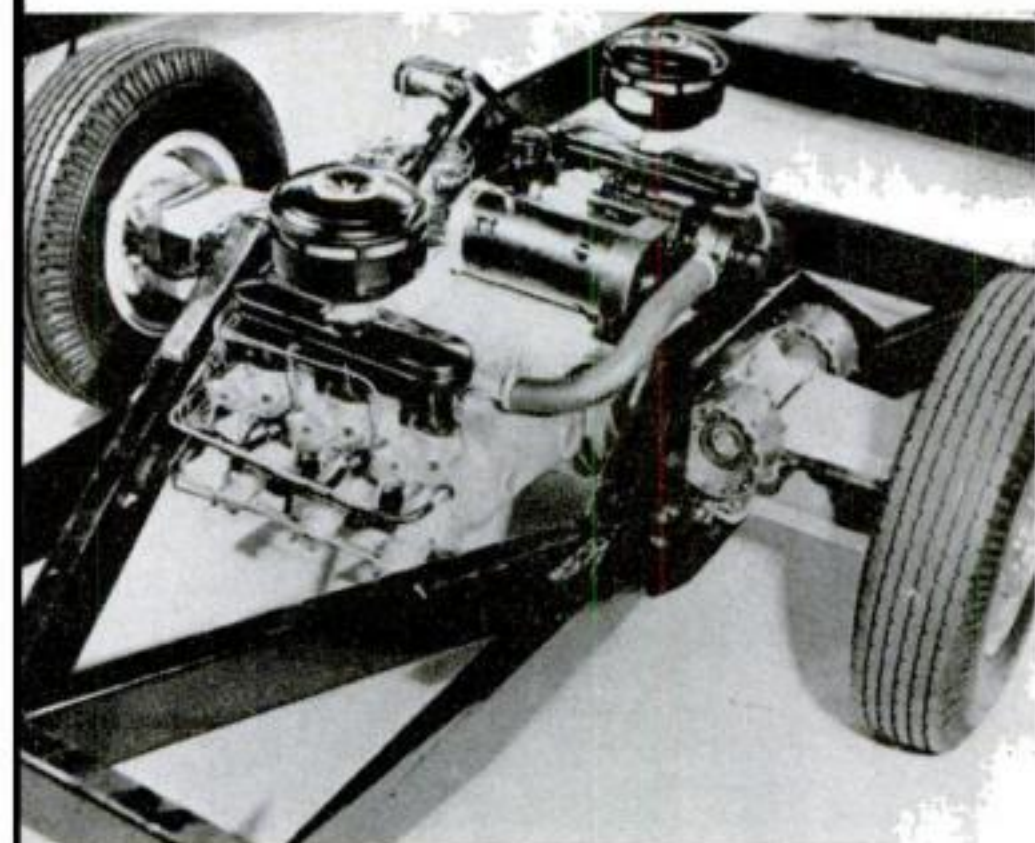
Ed Cole, Chevrolet general manager and General Motors vice president, and his team are used to solving problems, however. Despite the fact that the Lark or Rambler-size car they had in mind would be a big one by rear-engine stand-

REAR-ENGINE STERKENBERG designed by John Tjaarda in early 1930s was ahead of its time, later inspired the Lincoln Zephyr.

WILLIAM STOUT WAS STAUNCH in belief that rear engine location



never made the Big Time



PREWAR ROVER with engine in "boot" is ancestor of English company's current experimental gas-turbine car, which also has engine where trunk usually goes.

PANCAKE ENGINE used in Tucker back in 1946 was big and heavy compared to the air-cooled aluminum power plant Chevy is readying for its new model.

ards, they felt sound, careful engineering would overcome the difficulties.

The problems of handling—which showed up as expected in early experimental models—could be licked by good suspension design. Stylists and body engineers could supply trunk space which, if not up to Detroit's usual cavernous standards, would be at least adequate.

Two added bonuses a rear-engine compact car might have over a more conventional design provided Chevy with extra incentive to explore the possibilities.

The technical novelty alone would be a sales advantage in the market at which the car will be aimed. Volkswagen and the other rear-engine imports have done a good job of selling rear engines.

Even more important to men steeped in the very cost-conscious GM tradition: The rear-engine, rear-drive design lends itself to production economies. When you eliminate drive parts and reduce weight, you're going to save money.

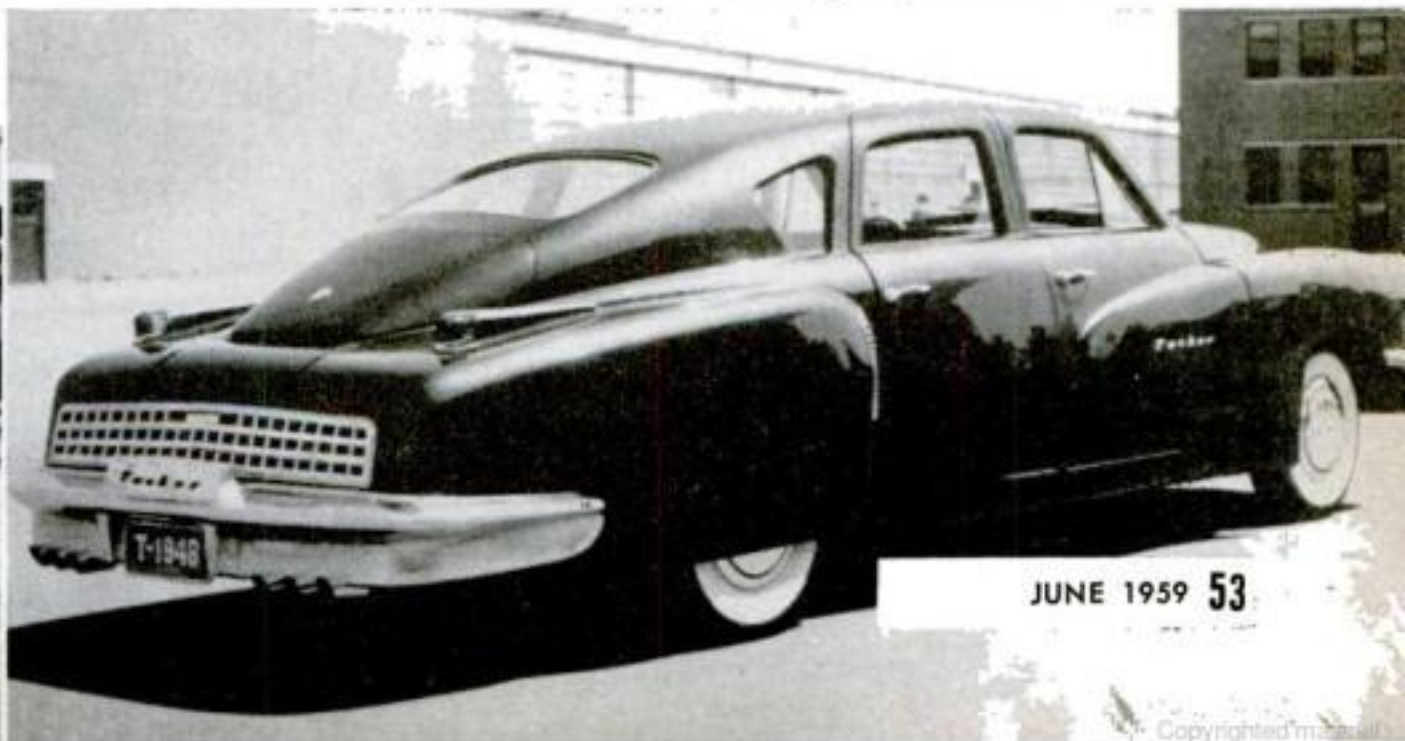
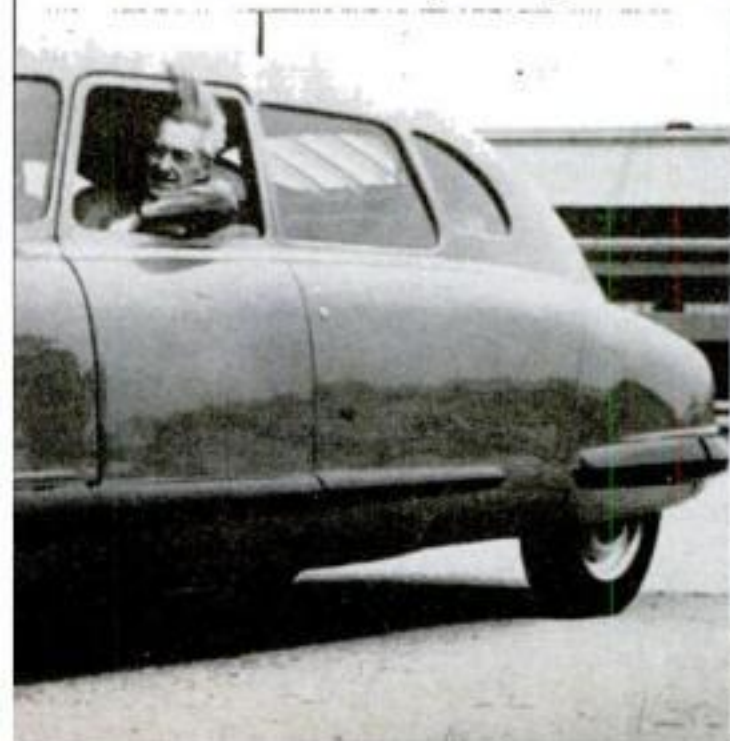
The engine. One of the first decisions Cole's team had to make involved the engine. It would have to be light to keep rear weight bias to a minimum, yet powerful enough to give a 2,700-lb. car (approximate target weight) performance acceptable by U. S. standards. This would require something in the 90-100 horsepower range, possible with an engine of about 140-cu.-in. displacement.

After looking over the possibilities, an air-cooled, flat opposed—or "pancake"—six-cylinder engine emerged as the best possibility. An in-line six would be too long and a V-6 (even though mention of such an engine always brings a gleam to Cole's eye!) too high. An opposed six with short stroke would cause no width problem and its low profile would ease the stylists' job.

Air cooling, rather than water cooling, would pare weight and eliminate the radiator. Air-cooled engines are noisier than conventional water-cooled engines, but

was most logical, built famous Scarabs in attempt to prove it.

PRESTON TUCKER'S TORPEDO aroused interest in rear-engine cars after World War II, but financial and legal problems killed it.



Rear engines have advantages



Floor can be flat; no drive tunnel is needed. Result: more leg room.



Car height can be lower than with engine in front because of low floor.



Steering is easier, parking simpler, due to less weight on front wheels.

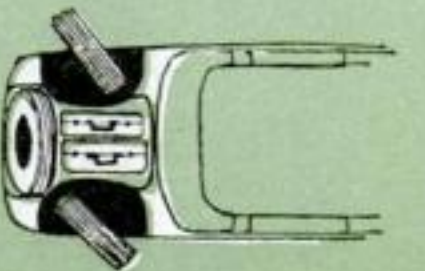
... And make problems



Rear-engine cars tend to oversteer, are susceptible to gusty crosswinds.



Control rods and cables are longer, more complicated, to reach rear.



Luggage space, limited by room needed to turn wheels, is scanty.

air flow in a rear-engine car carries engine noise away from the passenger compartment, not into it. Use of a good deal of aluminum was indicated to save weight; its excellent heat conductivity would also make air cooling easier.

Original reports were that the engine would be all aluminum. That is, it would have finned aluminum cylinder barrels clamped between aluminum cylinder heads and crankcase. To provide inside cylinder walls with adequate wear surface, cast-iron cylinder barrels or liners might be used.

Unit body. Unofficial word in Detroit is that Chevrolet is planning unitized body-frame construction of its compact car. This makes sense. Most successful rear-engine cars are made this way. It cuts weight and costs, keeps height down.

Independent rear suspension—probably the swing-axle type—reportedly has been chosen to give riding comfort close to that of “full-size” U. S. cars, despite the smaller Chevy’s 106- or 108-inch wheelbase.

Further details have come only with difficulty past Chevrolet’s security wall. It is known, however, that the car will be offered with a choice of standard or automatic transmission. Educated guesses are that it will have a top speed upwards of 80 m.p.h., deliver about 25 m.p.g. and have acceleration roughly comparable to current six-cylinder Chevies.

General Motors’ interest in rear-engine cars is not new. As long ago as 1931, W. J. Davidson, then technical director

for GM, stated that “rear-engine cars present features of merit” and admitted they were under “intensive study.”

Among the advantages he cited, not already mentioned, were better forward visibility and considerably reduced noise level. The former is not so important with today’s huge glass areas, though lower hood lines could mean still better vision to the front.

Better braking. More recently, Renault’s Fernand L. Picard produced an impressive list of more than 20 advantages of rear-engine cars. Braking loads, he says, are more evenly distributed—front brakes don’t have to do most of the work. Front wheels can be turned at a sharper angle, thanks to greater free space between them.

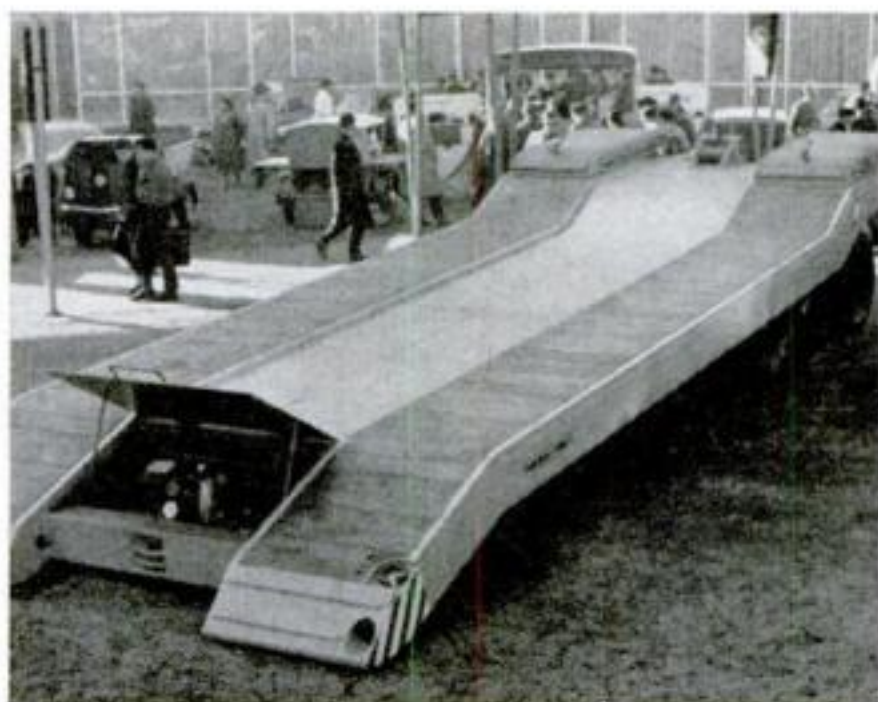
Picard, president in 1957 of the French counterpart of our Society of Automotive Engineers, also pointed out the reduced danger of carbon monoxide poisoning, since fumes are carried away from the passenger compartment. This is also true of engine heat, so rear-engine cars are cooler in summer. And the absence of mufflers, exhaust pipes and drive shafts means greater ground clearance.

These advantages, Picard recognizes, can be exploited more successfully in small cars with light engines: As engine size and weight increase, unbalanced weight distribution, with attendant handling and riding-comfort problems, becomes more acute.

This has not prevented periodic at-

[Continued on page 204]

PEN RADIO. A radio that fits in a case the size of a fountain pen is shown here with RCA's present smallest transistor set. Its electronic parts are micro-modules, tiny ceramic blocks .3 inch square, developed by RCA for the Army Signal Corps as part of a miniaturization program. The parts in the blocks include amplifiers, oscillators and other electronic elements.



RAMP TRAILER. This 60-ton flatbed trailer was built in East Germany to haul heavy road-building equipment. Its rear end lowers by motor to form a ramp.



BARREL WING. A turbojet behind the pilot in the French Coleoptère above pushes it off, lands it vertically. Once aloft, it goes into horizontal flight.

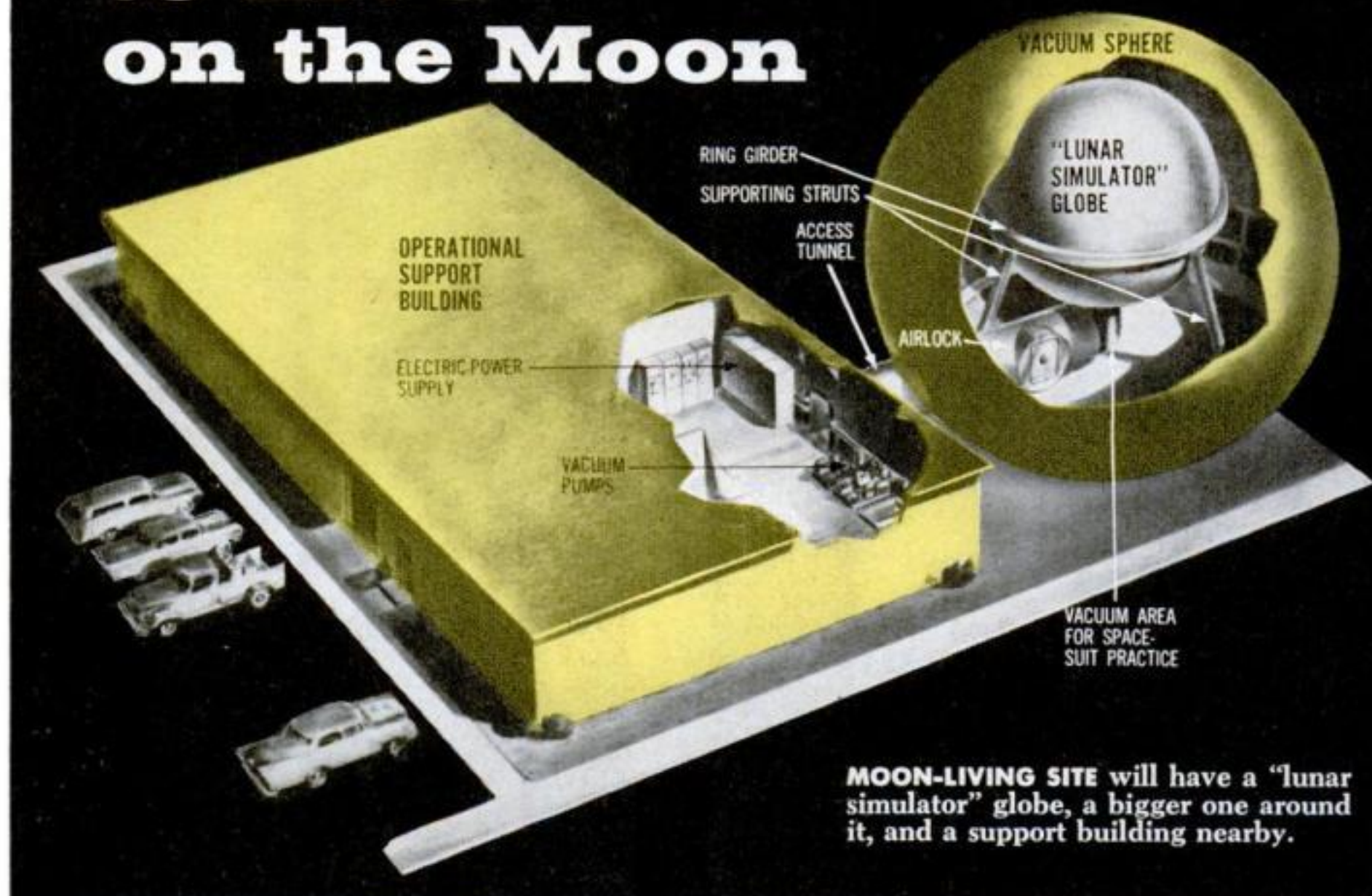


CRACK-UP. The odd, symmetrical pattern on the windshield at left looks like an etching. It appeared unexpectedly as Army Specialist Gene J. Terpstra was driving in Germany. He attributes it to stress on the frame when he jacked up the car to change a tire.

POWER-PLUS. Eight JATO rockets (four in ring at right) helped get this heavily loaded Lockheed C-130B Hercules off the ground at Eglin AF Base in Florida. Despite its gross weight of nearly 68 tons, the big plane became airborne in 2,300 feet.



Globe Will Train Men to Live on the Moon



MEN will soon practice living on the moon, to learn how to survive there when landings become possible. They'll use a 32-foot steel globe called a "lunar simulator." Its early construction for use by Air Force personnel is planned by the Martin Company at Denver, Colo.

Sealed off from our world for a month or more, five men in the sphere will seek to become self-sustaining. They'll replenish their own air, grow their own food, conserve and "recycle" their precious water, in a picturesque composite of pastoral and space-age surroundings.

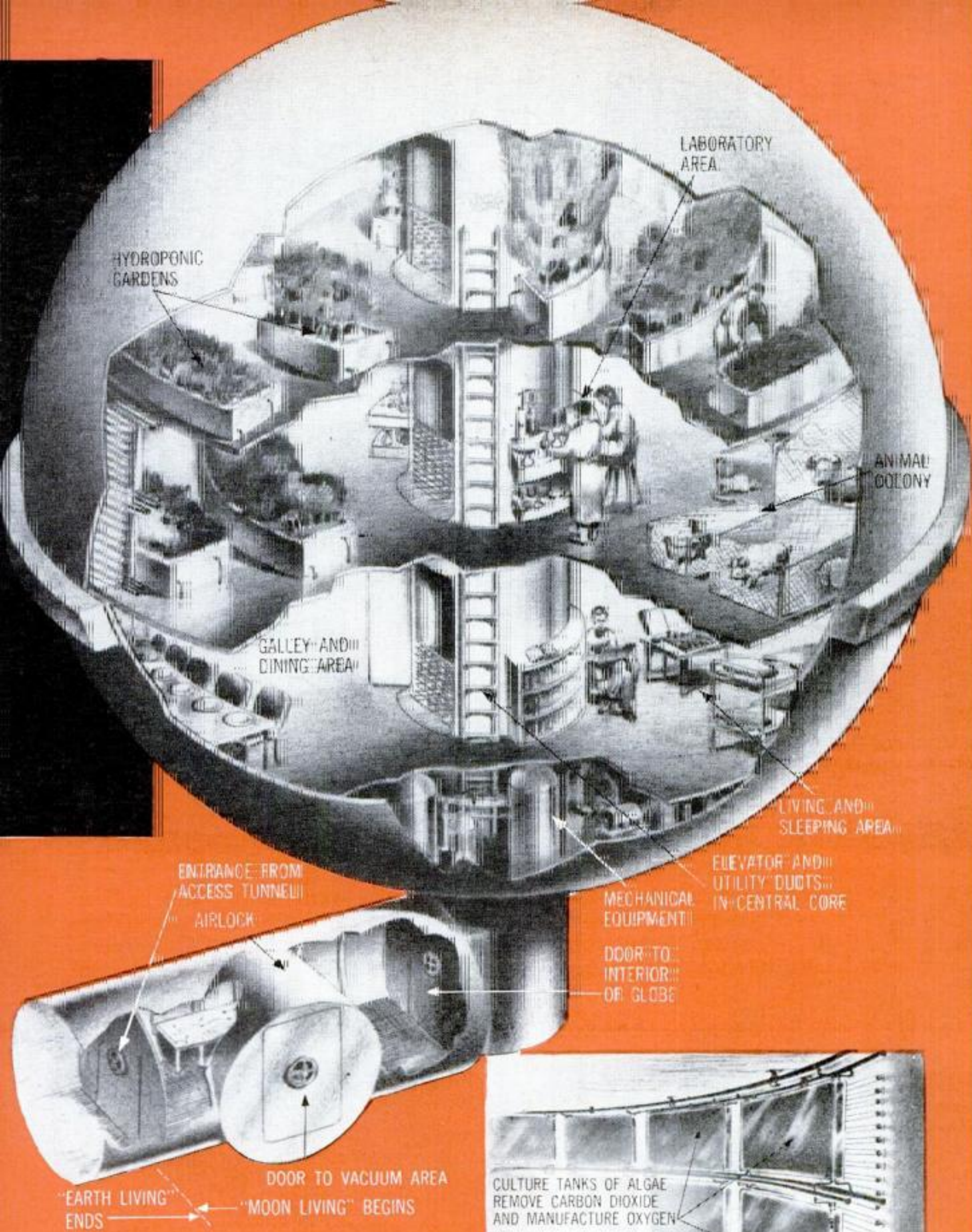
Like people of primitive customs, the moonmen will share their abode with domestic animals—cattle, pigs and chickens for their larder. They'll raise vegetables in ultramodern hydroponic or soil-less gardens. And they'll anticipate the future by growing green water plants (algae) in tanks, to remove carbon dioxide and generate oxygen. Four decks

within the sphere will provide living quarters and the novel equipment illustrated.

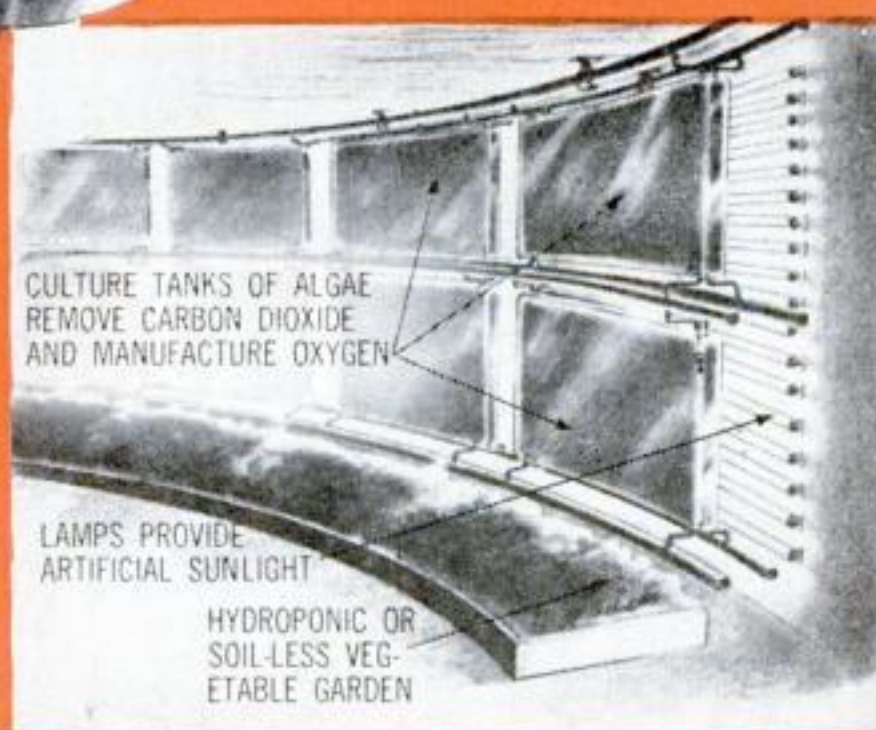
A near-vacuum will be maintained around the moon house by an outer 62-foot-diameter steel globe, to simulate the airless outdoor environment of the moon. Donning space suits, members of the lunar colony will sally forth through an airlock into this vacuum chamber, to practice construction and exploring tasks that they'd face on the moon.

Electricity from an adjacent "operational support building" will be one of the few outside aids for the first experimenters. A more realistic moon power plant, using solar or nuclear energy, will be incorporated in the setup as soon as available.

Waiting to solve the problems of lunar living until the moon is reached would risk disaster, Martin points out. By tackling them now, the moon-on-earth project aims to get the answers first.



MOONMEN IN GLOBE will grow food (as at right) on top two decks; eat, sleep, and have recreation facilities on next-lower one. Base holds mechanical equipment. Airlock, for entrance, also opens into vacuum area for space-suit adventuring.





A TOUR OF THE TOWN takes a hatful of coal. Front end is from an old Farmall tractor;

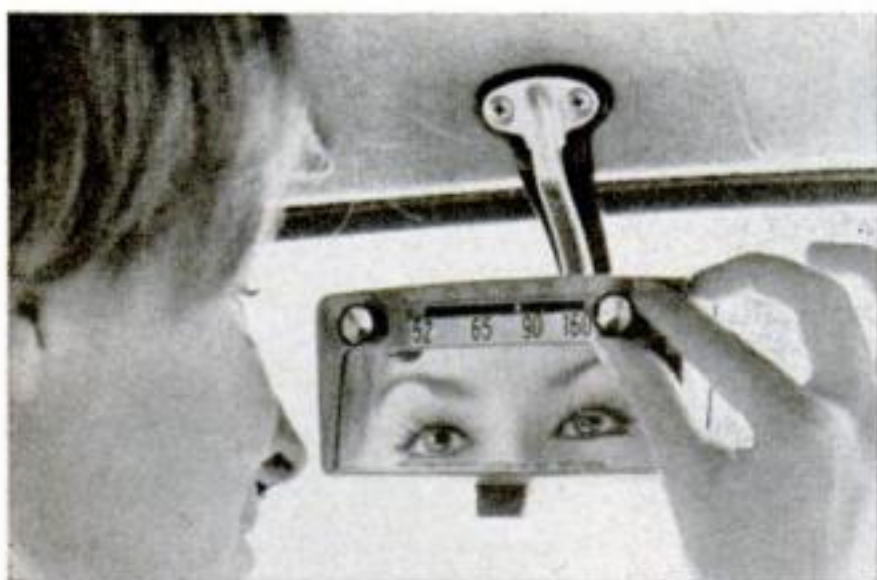
rear end, wheels and tires are from a Model T truck. Weight is about 1,950 pounds.

Steam Buggy Born of a Dream

WHEN an odd-looking, orange-colored contrivance comes rolling down the main street of Lexington, Neb., almost any nice Sunday afternoon, hissing steam,

breathing fire and smoke, it is indeed a dream come true for the man at the wheel—64-year-old William P. Feese.

One night Bill Feese had a dream about



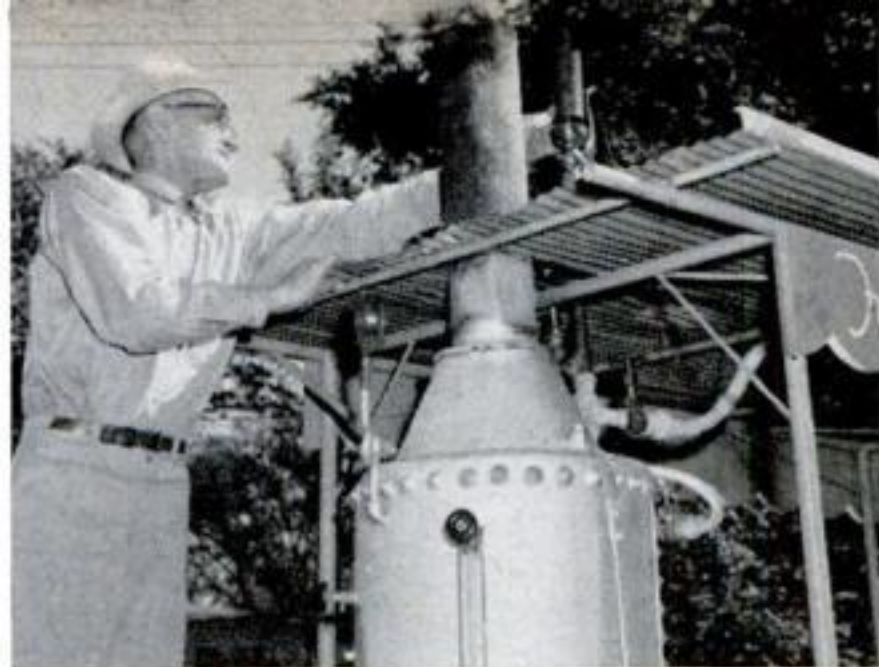
SIGHT AND SOUND. This motorist in Rome, Italy, now can look at herself while listening to music and the news. Mirror has a tiny, built-in radio.



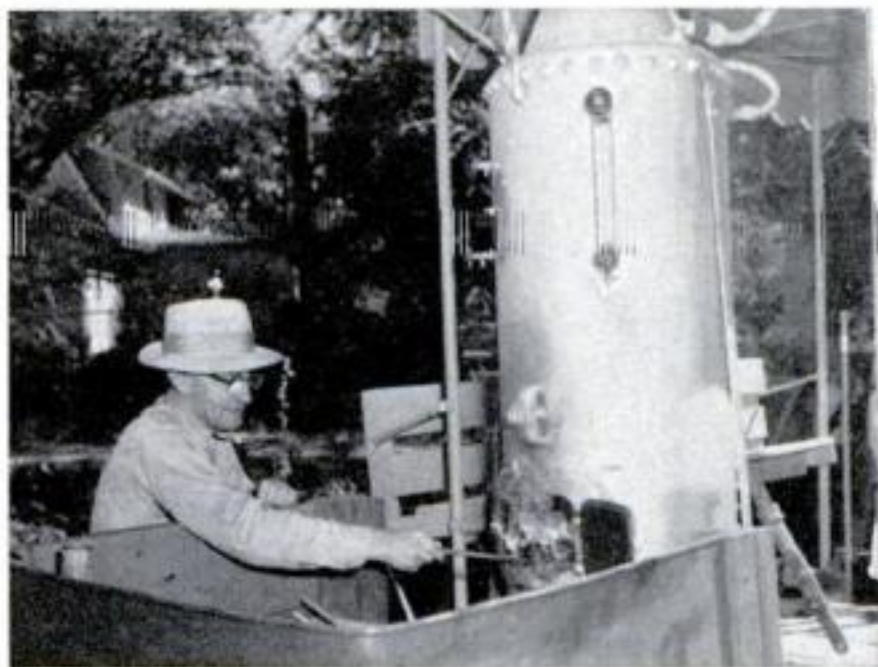
TANKER GIANT. Plowing the seas at 17½ knots, the 71,282-ton Princess Sophie is the biggest built in the U.S. She is 859 feet long, flies the Greek flag.



FIFTY-YEAR-OLD ENGINE, retired from hoisting operations, has a $4\frac{1}{4}$ " bore, 6" stroke. Lamp is decorative; Bill doesn't drive at night.



THE WHISTLE once rode a threshing machine. Today one long blast announces that pressure is up and the Steam Mobile is ready to roll.



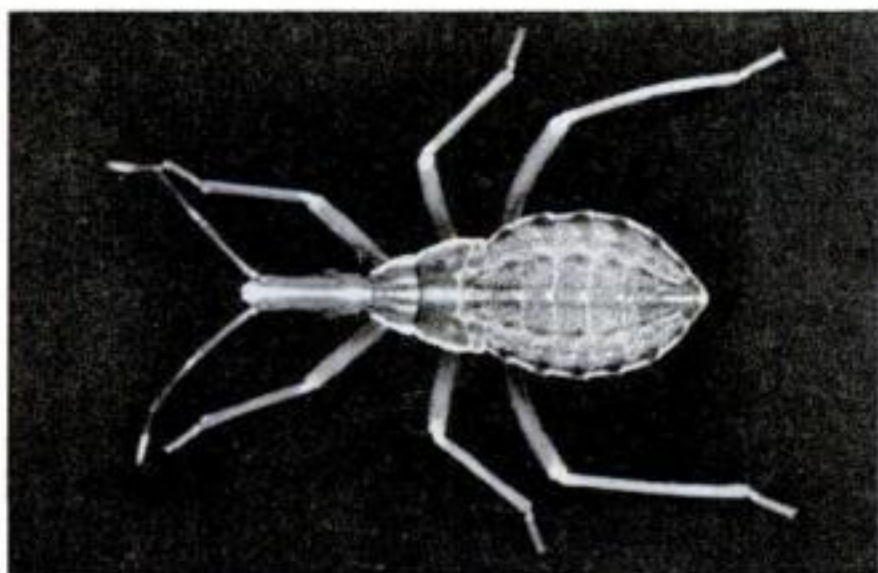
THE BOILER once served a creamery, burns wood and coal. Firing the dream wagon to get up 125 pounds' pressure takes about an hour. The boiler holds 30 gallons of water.



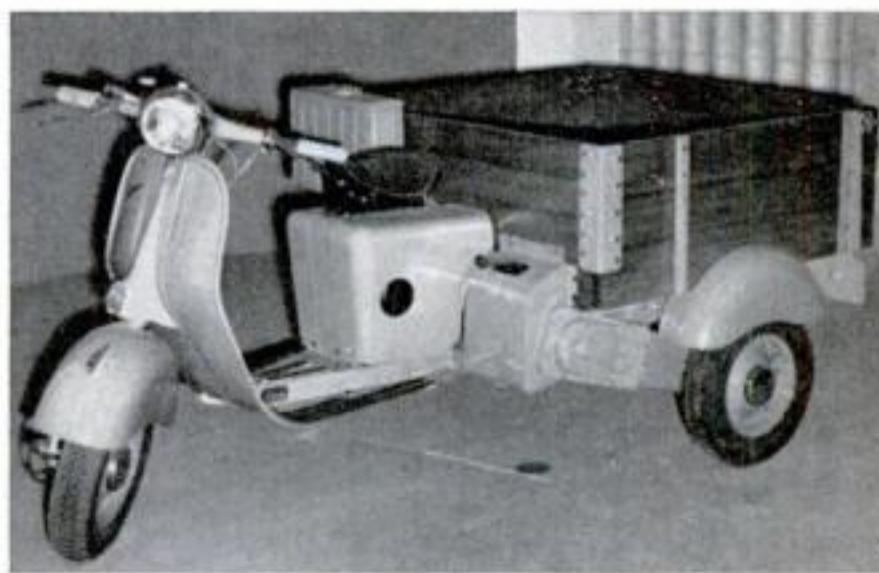
BILL FEESE AT THE WHEEL: Making his dream come true cost \$60 cash and 200 hours of labor (fun). The Steam Mobile has no transmission. To back up, Bill simply reverses the engine.

a steam car. Next morning he set out to build one. It took him a year to collect and assemble the parts. But now his Steam Mobile is a familiar sight in the

neighborhood—and when he toots the shrill whistle it draws the kids of Lexington as surely as did the tune of the legendary Pied Piper of Hamelin.



ATOMIC TOUGHIE. Cellular resistance enables this half-inch South American "kissing bug" (*Rhodnius prolixus*) to take radiation lethal to man.



SOVIET SCOOTER. Light-delivery vehicle shown at recent Leipzig Fair has a two-cycle, underseat engine. With a 550-pound payload, speed is 25 m.p.h.



All the latest devices for snaring smugglers from abroad are in use at Idlewild airport.

The dodges are often clever, but rarely new



AN AGENT'S SHARP EYES, still one of the best means of foiling smugglers, noted that this empty car sagged slightly. Investigation uncovered \$175,000 worth of gold in a rear fender.



ANCIENT SUBTERFUGE of hollowing out soles and hiding gems there is one of the riskiest. A woman too tall for thick soles was nabbed on these, containing diamonds valued at \$200,000.

How Science Is Making It Tougher for Smugglers

Geiger counters and X-rays now help trick-wise customs men expose even the slickest sneak

By Wesley S. Griswold

THOUGH there are always a few travelers each year who try to enter the United States with a covey of forbidden parrots hidden under their car or a package of heroin tucked inside the spare tire, or with cut diamonds in the hollowed soles of their shoes or watch movements sewn into their underwear,

there is probably no smuggling trick that hasn't long been familiar to the wary men of the Customs Service. After all, the U. S. has been scrutinizing the luggage, and sometimes the persons, of arrivals since 1798.

With the tourist season once more at its peak, around 2,600 customs inspectors are guarding the many doors to the nation, waiting for the same old tricks.

The new vigilantes. There's a deadly serious reason to be extra-vigilant these days. In addition to trying to catch cheats attempting to avoid paying duty and smugglers bent on sneaking in outlawed



UNDER THE RECORD PLAYER, there was once hidden a big load of marijuana, seized with its carrier. This is now one of many exhibits at a school for U. S. customs agents in New York.



FALSE COMPARTMENTS in luggage are common and often obvious. This trunk, though, with secret areas in back and drawers, was a masterpiece. But its cache of watches was uncovered.

purchases, they must be sure to nab anyone trying to slip past them with the terrible ingredients of an atomic bomb. Thus, every port of entry is equipped with highly sensitive Geiger counters, hidden from incomers but probing each one—and his baggage—as he passes by. If one of these instruments buzzes an alarm, inspectors converge with handheld Geiger counters to pinpoint the location of the radioactive substance that gave itself away.

So far, happily, nobody has been found carrying plutonium in his pockets or suitcases, but the silent sleuthing of the Geigers has unexpectedly exposed some less sinister culprits. The counters have occasionally sensed the presence of craftily secreted foreign watches with radium paint on their dials. There is even a comic touch to this kind of ferreting. Customs inspectors with Geiger counters not long ago descended in force on one woman's trunk, only to find nothing more dangerous than a clock with luminous hands.

Since last July, more than 140,000,000 people have entered this country. (That's an official figure, but misleading: A person is counted every time he comes in, and many do it repeatedly.) In the 12

months ahead, if the present annual gain in traffic continues, we'll have nearly 143,000,000 arrivals. They'll come in by plane, ship, train, bus, ferry, truck, car, wagon, motorcycle, bicycle and on foot. Except for a handful of desperate individuals who will creep across the Canadian or Mexican border in wilderness areas, they'll all have to pass customs.

Favorite dodges. Smugglers still use the most obvious hiding places: the linings of luggage and clothes, the heels and soles of shoes. And a lot of indignant ladies have found that their precious handbags were not, as they had imagined, sacred to the customs men.

But there have been diverting examples of a fresh approach to subterfuge. Some of the more imaginative incomers have hidden valuables in stuffed animals, hatbands, false teeth, wooden legs, baby's bottles, the rolled-up ends of partly used toothpaste tubes, trusses, flower bulbs, soap, hairbrush handles, hearing aids and parts of their bodies. And yet they have been caught with the goods.

Arrivals have sometimes tried to bring in heroin, which is white and odorless, in a baking-powder can. But customs men literally have an acid test for any white, unscented powder they suspect. Each inspector carries a tiny vial of a clear, special fluid that merely makes baking powder fizz; but when a drop of it lands on heroin, it turns purple. This test does not clinch the matter, but it is bound to lead to more intensive analysis.

Crossing the borders. People in cars sometimes ingeniously extend the range of hiding places for smuggled items. This has been especially true at San Ysidro, on the line between California and Mexico. Inspectors there have found jewelry tied in little packets among the springs of seats. They have discovered packages of narcotics in false cells in batteries, in fender wells, inside tires and in metal pouches soldered into gasoline tanks.

Once, an inspector with a flashlight accidentally located an extra fuel tank underneath a car that was entering the U. S. at San Ysidro after dark. There wasn't a drop of gasoline in it, but it did contain a dozen sleepy parrots. One of them, seeing a streak of the inspec-



IT TAKES A WOMAN to search another thoroughly, and since women more often try smuggling than men do, the U. S. Customs Service has female inspectors for the job, if it has to be done.

your person

INSPECTOSCOPE, shown here at Idlewild, probes with X-rays for hidden metal, especially watch movements, jewelry mountings and bar gold or platinum. An inspector sits before a fluoroscopic screen in the booth at left. When he turns on X-ray apparatus located in the compartment at right, he can instantly see through trunk, suitcase or crate.



tor's light through a breathing hole, squawked and gave the game away.

The reason for this odd, stealthy traffic in parrots is that they cost only a little more than a dollar apiece in Mexico but sell for as much as \$75 apiece here. You may bring two parrots in with you, but only if you can prove to the health authorities that you've had them for four months and that they are not carriers of the perilous parrot fever. Smugglers of parrots and other hook-billed birds try to dodge this restraint on their trade, but most of them fail.

Most travelers are honest. At least that's the polite theory of the Bureau of Customs. But a customs inspector is trained to suspect even his gentle old grandmother if she happens to be returning from a foreign country. One hard-

bitten veteran at San Ysidro told me sourly, "Every tourist is a potential smuggler. And it is inherent in an American to try to beat the government."

Most Americans apparently stifle this impulse when they travel, however, for though many millions of them ventured into foreign fields last year, relatively few were caught in attempts to smuggle anything home. The value of all merchandise seized from both returning Americans and visiting foreigners in the fiscal year ending June 30, 1958, was under \$8½ million.

Customs inspectors sometimes seek the help of a bulky X-ray gadget called an Inspectoscope. This shows them faint pictures on a fluoroscopic screen of any metal objects hidden in luggage or crates,

[\[Continued on page 200\]](#)

This Is How We Might Catch an Atomic Smuggler

WHEN Soviet Deputy Premier Mikoyan was about to board a commercial plane to fly from San Francisco to Los Angeles during his recent visit to America, a police inspector with a Geiger counter checked the luggage of every passenger. This was to guard Mikoyan from the weird possibility of assassination by radiation poisoning. Similar, largely secret, means are in force at all U. S. ports of entry to protect this nation from the chance that a foreign agent might smuggle the fissionable ingredients for an atomic bomb into the country in his traveling bags.



New U.S. Scooter

Harley-Davidson enters the scooter field with the lively, high-style Topper

I reached down, grabbed the starter handle and yanked it upward. Topper's engine fired.

A BRAND-NEW U. S. scooter takes to the road this month. It's the Harley-Davidson Topper, a squat two-seater with automatic transmission, pull-cord starter and two-tone fiberglass body.

I rode one at the factory in Milwaukee and found it impressive. Sitting comfortably on the soft dual seat, I reached down, twisted the ignition key and shoved the transmission control lever to

START. With the twist-grip throttle cracked slightly, I yanked the starter rope upward, outboard style.

The two-stroke engine revved happily—but I couldn't make her go.

"Slide the transmission-control lever to running position and idle down," the engineer advised. "For safety, when the machine is stopped the transmission won't take hold at over 1,800 r.p.m."

TOPPER'S ENGINE lies on its side, cylinder head forward. A variable-diameter, centrifugally operated pulley on the crankshaft uses a V belt to drive a larger variable pulley on a countershaft. Final drive is by chain from countershaft to rear-wheel sprocket.

STARTER-CORD HANDLE

CYLINDER HEAD

CRANKSHAFT PULLEY

IGNITION LOCK

TRANSMISSION CONTROL LEVER

V BELT

COUNTERSHAFT PULLEY

REAR-WHEEL SPROCKET

GAS TANK

CARBURETOR AIR INTAKE

Shifts for Itself



She heeled over readily as I leaned into fast turns.

Zero to 30 m.p.h. took only eight seconds—zippy for a scooter.

Making tight circles, I cramped the big 12" wheels over easily.

I closed the throttle completely for an instant, then opened it. Topper took off briskly, accelerating steadily as I fed more gas. On full throttle she was bounding along at better than 45 m.p.h.

Rounding sharp bends, Topper heeled far over without fuss. Her large wheels and low center of gravity helped explain good handling. Thick tires, a robust suspension and a rubber-padded seat soaked up even the biggest road bumps.

Stopping was a pleasure for the first time on a scooter. There was no shifting down and both brakes were potent. The rear brake pedal was just forward of my right toe, as in a car—not behind the left ankle, as on some imports. A handlebar lever operated the front brake.

How does the Topper stack up? Its price will be competitive—probably under \$450. And it has three main features that Harley-Davidson figures will appeal to American males: styling, automatic transmission, and those 12-inch wheels.

The automatic transmission, which works by varying the diameter of V-belt

sheaves, is Topper's most welcome feature. It makes good sense on a small, two-cycle engine that would otherwise have to be shifted often in traffic. It also eliminates two controls on a small vehicle already overburdened with them.

Tire size is extremely important on a scooter. A broad-tread tire soaks up more road shock than a narrow one. And a large-diameter tire steers and corners better than a small one. Topper's tires are 4:00 by 12, as broad as any and bigger around than all but one.

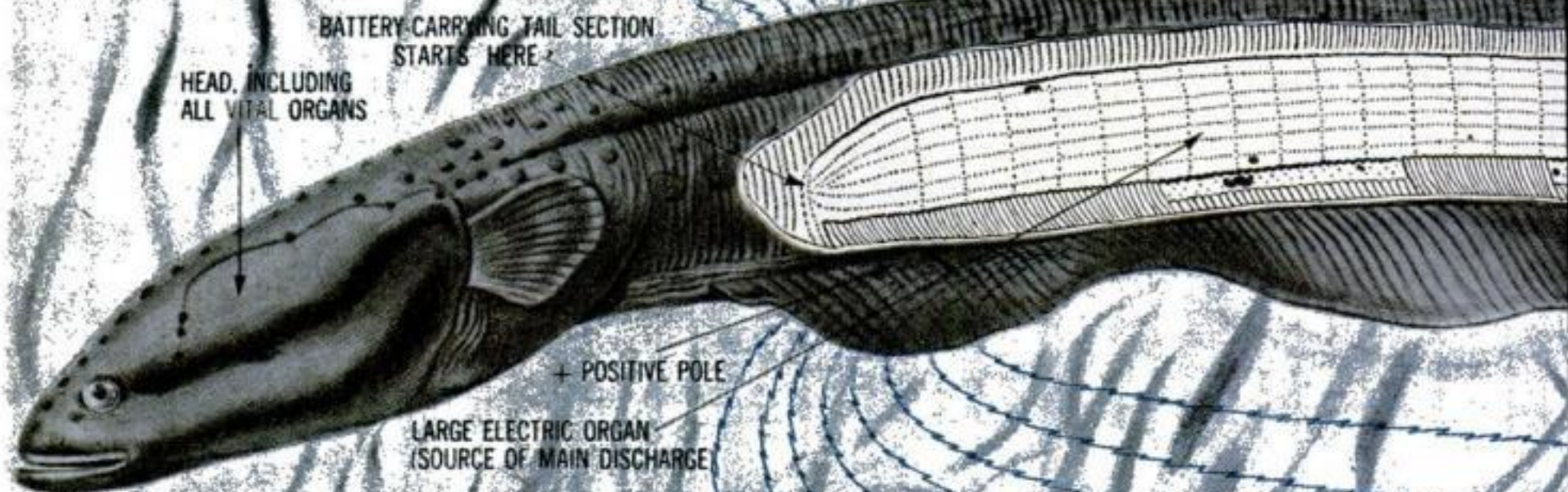
By locating the engine on its side, cylinder head up front in the airstream, H-D engineers have neatly solved some problems and created others. On the credit side is elimination of a cooling fan and better weight placement. The center of gravity is very low (specially with the light fiberglass body) and weight distribution fore and aft is almost even.

Not so good is the wide engine cover between your feet. Straddling it, I found, makes for an awkward, legs-apart seating position.—*Erik H. Arctander.*

TOPPER SPECIFICATIONS

Cylinders 1 (two-cycle)	Weight 237 lb.	Saddle height 30 in.
Displacement . 10 cu. in. (165 c.c.)	Wheelbase 51.5 in.	Tire size 4.00 x 12
Compression ratio 6.6:1	Length 75 in.	Gas-tank capacity 1.7 gal.
Transmission Automatic;	Width 24 in.	Gas consumption 80 m.p.g.
variable-pitch pulleys and V belt	Height 37 in.	Top speed 45 m.p.h.

Secrets of how Nature's strange swimming powerhouse produces up to 625 volts may lead to a new kind of man-made battery



Danger...high voltage!

The Amazing Electric Eel

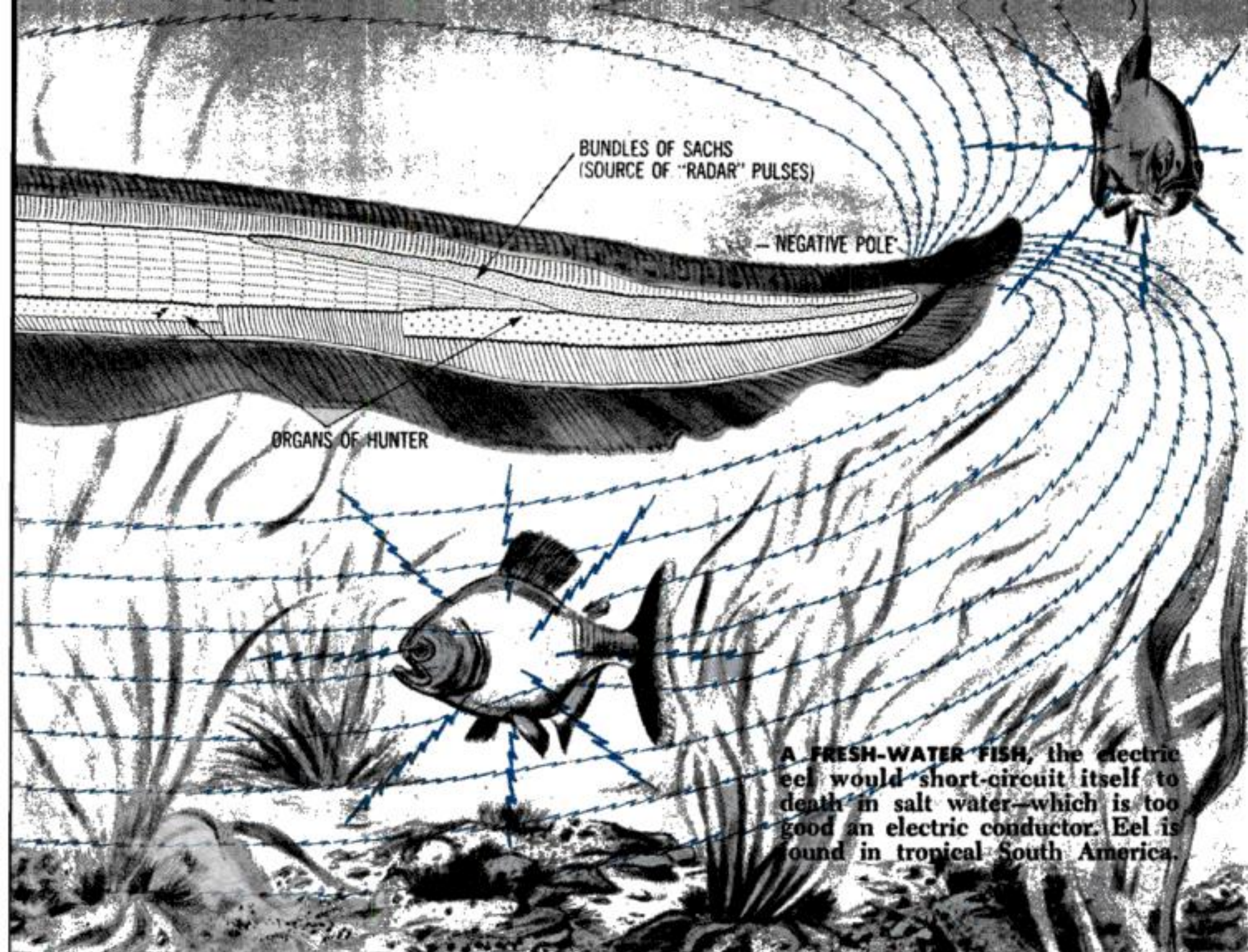


ADULT EELS range up to nine feet long and 80 pounds. Here, C. W. Coates, a pioneer in eel research, shows off one of his specimens. Rubber gloves are worn to avoid electric shock.

By Gardner Soule

THE electric eel is a living battery that can deliver an electrical jolt hefty enough to stun an ox—or kill a man. It is such an efficient producer of electricity that the National Inventor's Council, a clearing house for ideas for the military services, recently added to their list of most-wanted inventions a man-made source of electricity patterned after the electric eel. They want a battery that can deliver as much juice for its volume, last as long, and recuperate as quickly as the electric muscle this unique fish uses to hunt its prey.

"The discharge of the electric eel is the most powerful electrical force in the whole animal kingdom," says Christopher W. Coates, director of the New York Aquarium. For 27 years, Coates has made the electric eel his principal scientific interest. Working with other scientists, he has hooked the eel up to a whole array of electrical measuring instruments. Over the years he has learned a lot about the characteristics of the exter-



nal discharge, but much of what goes on inside the eel's electric organs is still a mystery.

The eel is one of two fishes that discharge electricity to kill or stun their prey; the torpedo is the other. Other fishes (electric catfish, skates, mormyrids and stargazers) do produce electricity enough to shock, but use it to drive away their enemies or to signal with.

Come and get it. When dinner—a fish, frog, or worm—swims near an electric eel, the eel's electricity does its work. From the eel's brain, its network of nerves carries the command to discharge the death ray to every cell in its great battery.

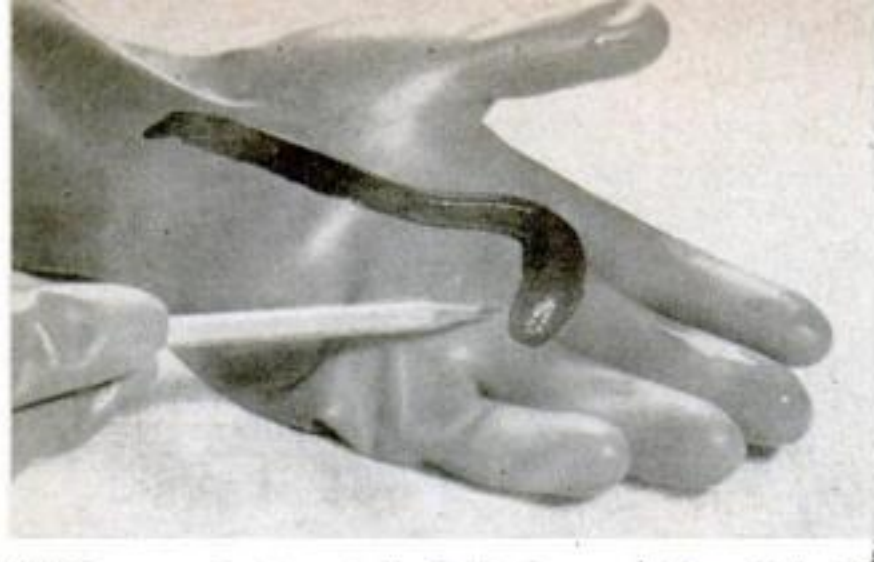
The last four-fifths of an eel—its whole long tail—is made up only of backbone, swimming muscles, and batteries. In the front one-fifth—in the foremost 21 inches of a nine-foot eel—is the complete animal minus electric power.

The great battery that hurls the major discharge consists of what are called the Large Electric Organs. A pair of them runs along the tail. The organs are

made up of electric tissue, a modified muscle tissue not fully understood but a kind of flesh that is unlike any other in the animal world. It is white and jelly-like, and it quivers when, as I did, you hold a slice in your hand.

This living battery consists of some 70 parallel columns of 6,000 cells (called electroplaxes). Each of these cells produces about one-tenth of a volt. They are insulated from each other by nonconducting tissue. To produce a discharge, they apparently are connected electrically, in a series-parallel arrangement, through nerve-conductors in the spinal column. The end of the organ toward the head is the positive pole of the battery and the tail end is the negative pole.

Bigger eel, bigger batteries. The size of the individual cells varies with the size of the fish. In a small specimen, there may be over 700 cells in a one-inch length of electric tissue, so that a voltage of 70 to 75 volts per inch can be measured along the length of the fish. As it grows, the cells enlarge in length, so that in a large fish there may be only 10 or 11



INFANT EELS become independent of their parent when five or six inches long. At this length they are already capable of 200 to 300 volts.



FEARSOME-LOOKING SNOUT is harmless except as a terminal for electric discharge. There are no teeth. Food must be swallowed whole.

cells per inch. The voltage per cell, however, remains the same. Thus the battery grows by increasing the size of the individual cells rather than by increasing the number of cells. While the total voltage tends to remain constant, the larger cells can deliver more current.

The voltage delivered during the major discharge differs among individual fish. The highest that Coates has measured is 625 volts. More typical is between 300 and 500 volts. The short-circuit current is commonly around one ampere. If an external circuit is matched to the eel's battery so that maximum power is delivered, you get about 40 watts output.

Who throws the switch? Every discharge by an eel is voluntary—it is entirely controlled by the fish itself.

A theory about what happens inside a cell has been developed recently, since radioactive potassium and sodium became available to check on the movements of potassium and sodium ions. The eel's great flow of juice is caused, scientists believe, by sodium seeping into each cell as potassium leaks out.

The discharge is short. It lasts two one-thousandths of a second. This is less time than it takes the eel's brain to tell the tail-end cells farthest from the brain to produce electricity. You might expect from this that the cells near the end of the tail wouldn't produce until

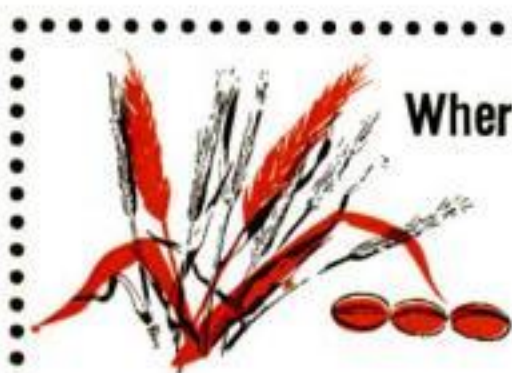
after other cells near the head had shot their bolt and stopped. It doesn't work that way. Somehow, again by means not understood, all the cells discharge at almost exactly the same instant. This gives the eel its fullest power for use against its enemies or prospective meals.

All or nothing. The eel never hurls a single bolt. The pulses always go out in bursts of 10, one right after another. These pulses—interrupted direct current—can stun or kill an animal or man up to 20 feet away. A fresh eel can discharge up to 400 thunderbolts in a second. As his battery runs down, the number will reduce to 150 or 100 a second. But it only takes five minutes of rest to recharge its batteries.

The eel will literally discharge itself to death if it is short-circuited. This was first discovered when an eel was laid out on an aluminum-topped table in the course of some early experiments. For the same reason, it cannot live in salt water, which is a good electric conductor.

Once having stunned or killed its prey, the eel swims up to it and nuzzles it. If the victim is too big to be eaten, the eel will swim away, and the victim may recover. On the other hand, the shocked animal may thrash around again in the water and so attract another thunderbolt from the eel and be stunned again. This

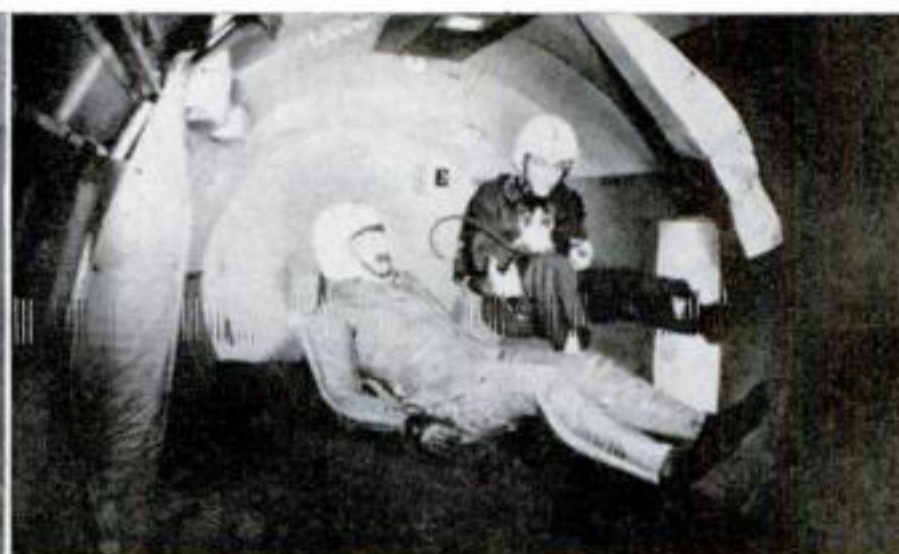
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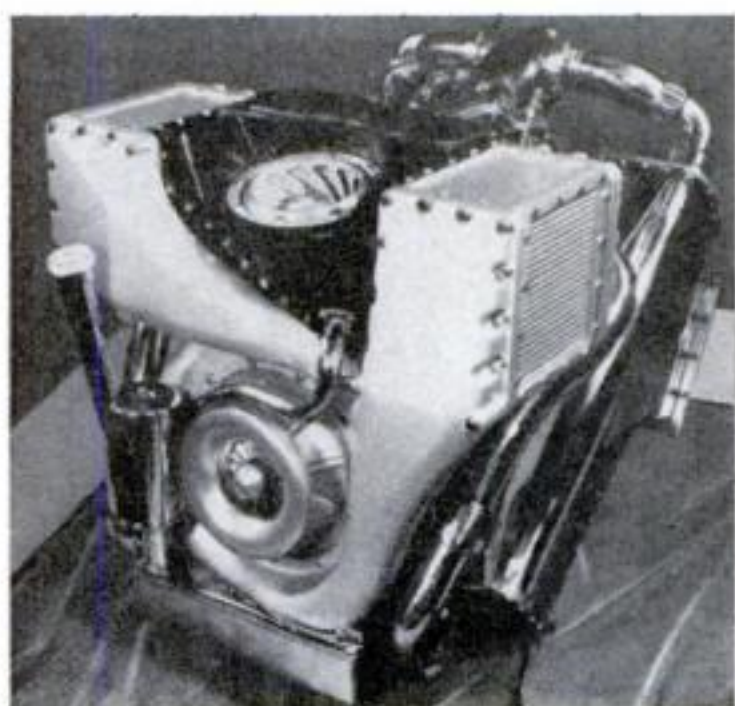
Where'd it come from?

INCH: "3 grains of barley, dry and round, placed end to end lengthwise" . . . was Edward II's official recipe

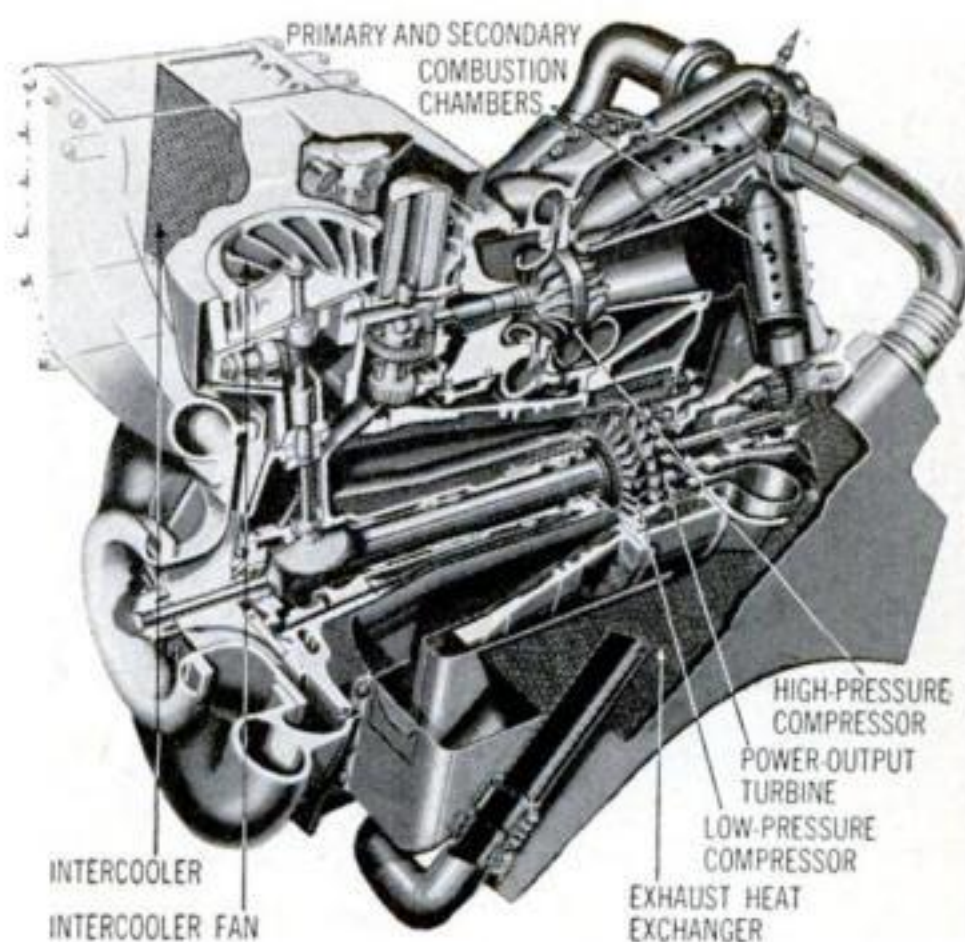
for the inch set forth in 1324. (Thirds of inches were once called "barleycorns.") The word itself reveals early relations with foot measure: It's derived from the Latin "uncia"—twelfth part.



FLY WALKER. Magnetic shoes enable this technician to walk on the ceiling like a fly as the plane he is in flies in an arc that makes him weightless. Tests by the Air Research and Development Command are designed to find means by which a space voyager could get around without gravity's help. Above, at right, one weightless experimenter floats idly, while another propels himself with a reactor gun (close-up in lower photo) which shoots compressed air, held in bottles on his back.



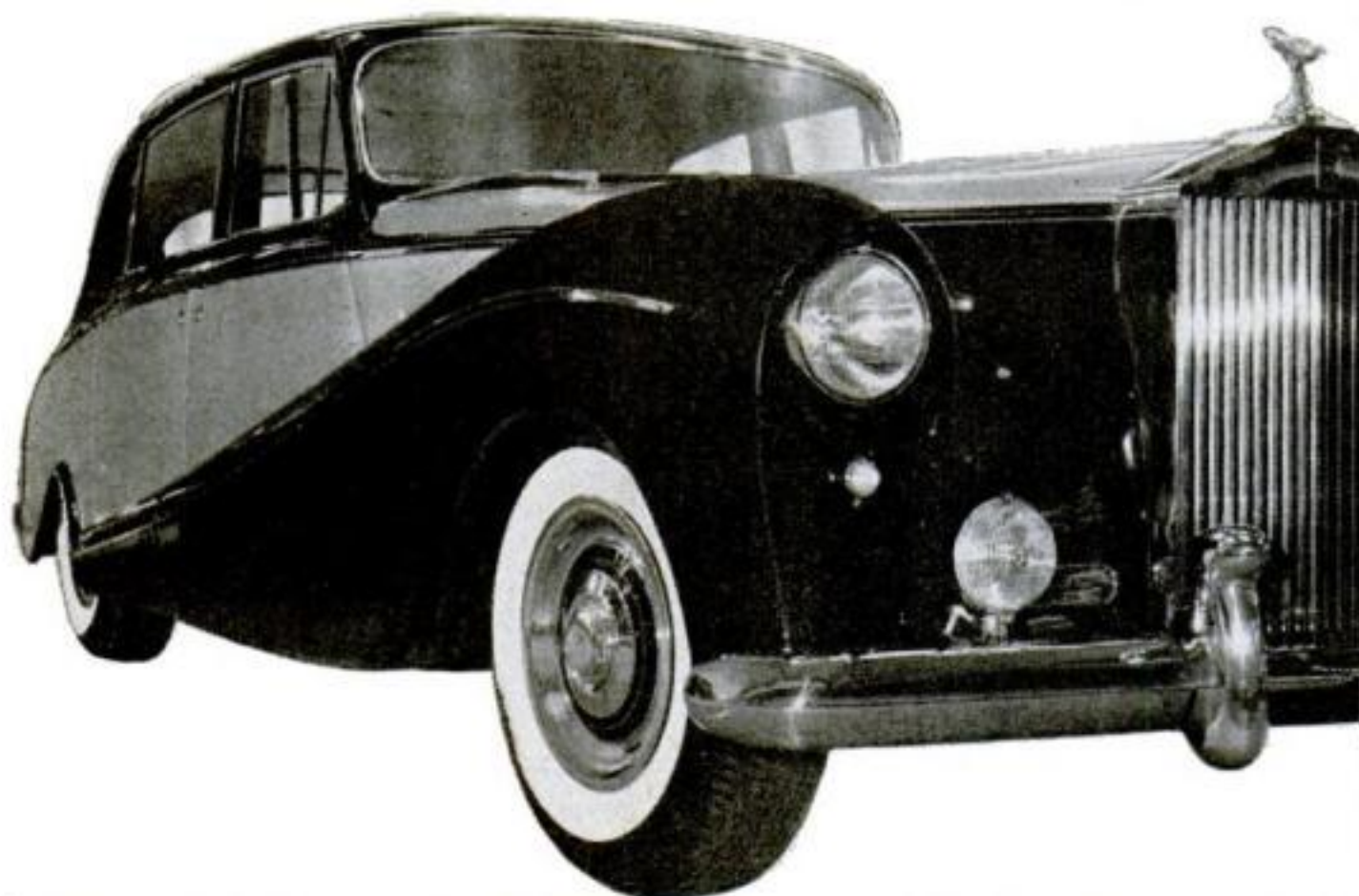
FORD TURBINE. Here's an experimental supercharged gas turbine designed by Ford for trucks and passenger cars. It has two air compressors and two burners, develops 300 hp., runs on unleaded gas, kerosene, jet fuel or light diesel oil with the efficiency of a diesel of comparable power, and burns less than conventional gas engines. The new turbine weighs 650 pounds (against 2,700



pounds for a 300-hp. diesel), measures 28 by 29 by 38 inches and fits into a '59 Ford. Engineers say the "704" gets maximum fuel economy in a range of 25- to 100-percent power while earlier turbines were efficient only at full power.

New Imports Are Full of Surprises

DAF needs no greasing . . . Build-it-yourself Nobel comes in a box . . . Rolls revives the running board



REGAL ROLLS ROYCE with Hooper body retains the boxy radiator but has daringly back-swept front fenders and graceful rear fender skirts. Opening the rear doors drops folding running boards (\$231 extra) to let passengers alight with ease. Elec-

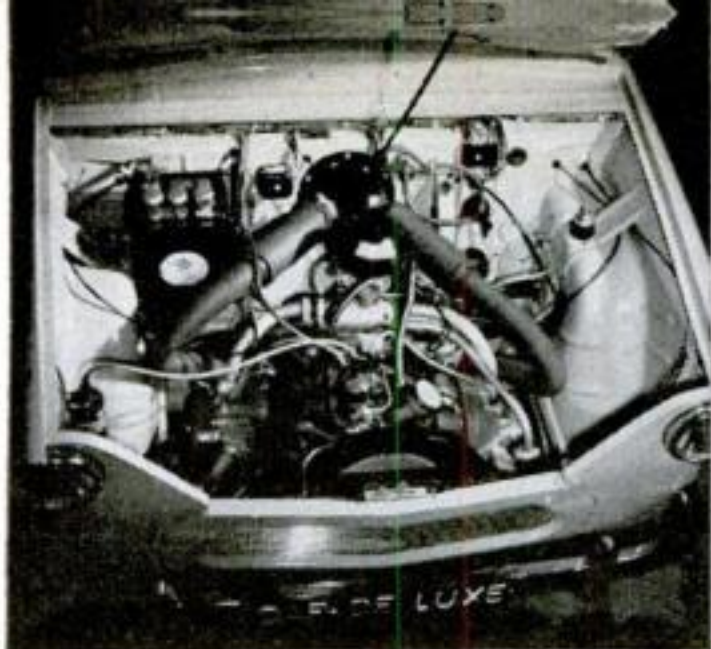
trically operated windows at \$640 include a pane between front and rear compartments. Rear-seat back and dash are wood paneled, with inlay borders. Total price of \$23,346 includes all of the extras mentioned, plus power steering.



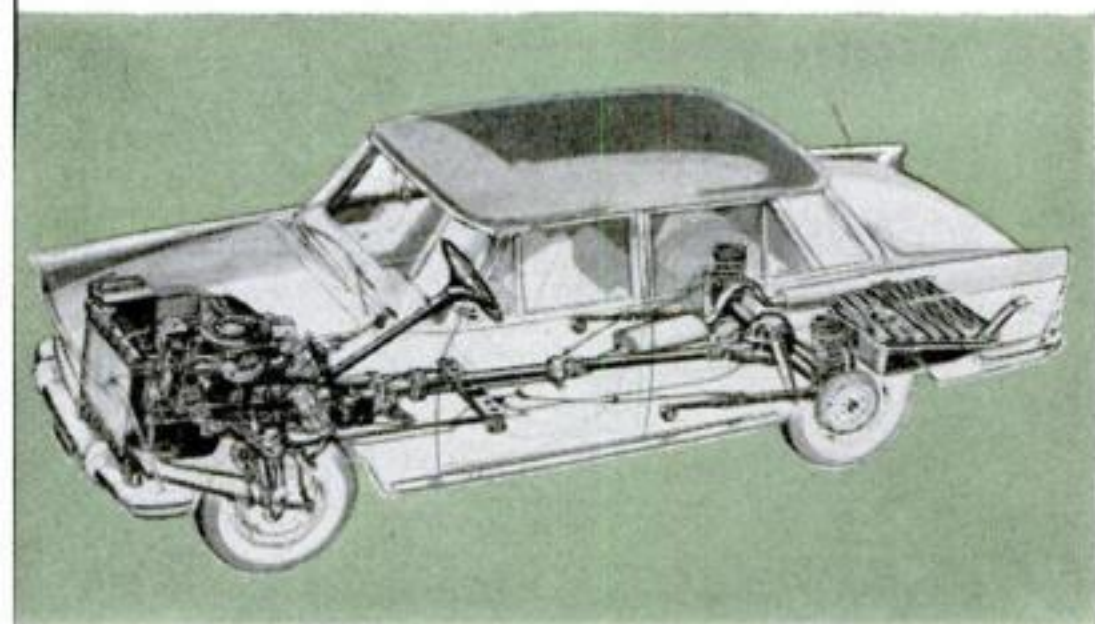
BUILD-IT-YOURSELF NOBEL. English midget car can be bought knocked down (\$885) or ready to roll (\$998). The rear wheels are 17 inches apart, front ones 48. A single-cylinder, two-cycle, 10-hp. engine delivers 90 miles per gallon and a top of 63 m.p.h. The body is of polyester plastic with rearward opening doors.



RENAULT GOES SPORTY with its new Caravelle line. The convertible shown has a removable hard top; a coupe and a soft top will also be offered. Headlights are recessed, rear fenders finned. The rear engine grille is chromed. Overall length is 165 inches—10 more than the popular Dauphine. Prices start at \$2,400.



ECONOMY GOES AUTOMATIC IN DAF, the Dutch car that shifts for itself and never needs chassis lubrication. Built on an 81-inch wheelbase, this 1,390-pound, four-passenger car has no clutch, differential or gearbox. Power is transmitted by heavy-duty V belts running on variable-diameter pulleys. Stepless-ratio shifts from a high of 20 to a low of 4.4:1 are effected by centrifugal action, with overriding control by engine vacuum. The engine is an air-cooled four-cycle opposed twin of 22 horsepower. Despite its miniature size, the Dutch car provides good passenger room. The steering wheel is the dished safety type. Two glove boxes, a heater and a low-fuel warning are standard equipment.



FIRST FIAT SIX since the war, the new 1800 has a 125-cu.-in. engine with 8.8:1 compression, delivering 95 hp. and a top speed of 93 m.p.h. Torsion-bar front springing, ball joints, a hydraulic clutch and fully synchronized four-speed transmission are other features of this new 104-inch-wheelbase line, which will be offered first as a sedan at \$3,192, later as a station wagon.

ENGLISH AUSTIN A55 (right), restyled for Americans by Italian designer Pinin Farina, sports a wide front grille, extra front chrome, a big wraparound windshield and modestly upswept fins. Engine output is up to 53 hp. *[Please turn the page.]*



A FIAT FOR FUN is the tiny Jolly above, with reed seats and a fringed surrey top, styled by Ghia, designer of the VW Karmann-Ghia. Powered by the Fiat 500 air-cooled engine, this buggy costs \$1,760.



More New Imports



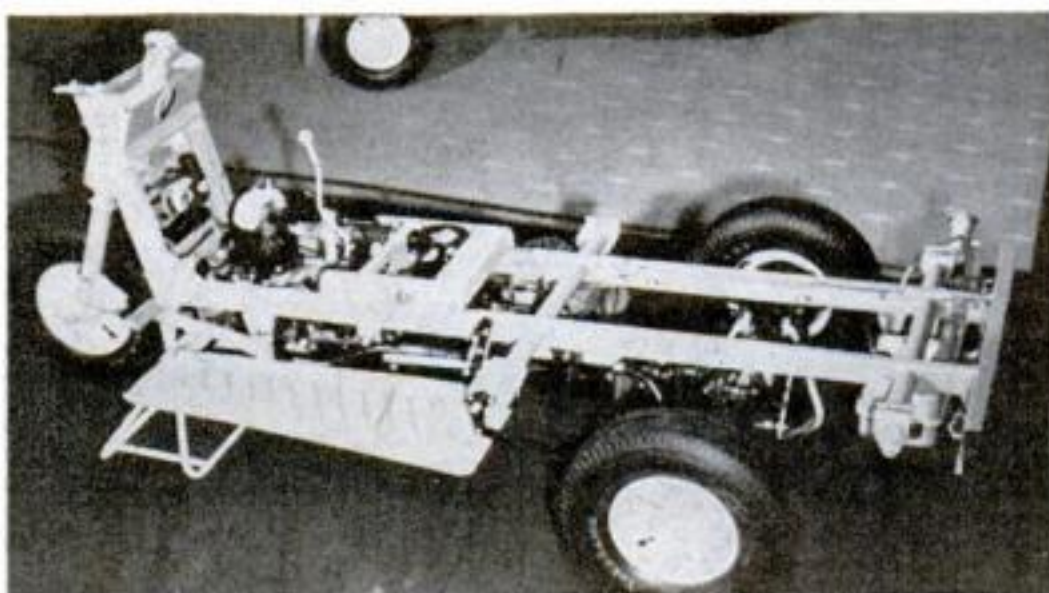
FRANCE'S FACEL-VEGA, sleek and low, sports a 360-hp. Chrysler Typhoon engine, claims zero to 100 m.p.h. in 21 seconds. The four-door model shown, for which you ante up \$13,075, has electrically oper-



ated windows, aluminum-fin brake drums, and a whopping 33-gallon gas tank. Buyers may choose a pushbutton transmission or a four-speed box. Instrument panel (right) is of natural wood.



ONE-LUNG TRIMOBILE. This Daihatsu three-wheeler from Japan delivers at \$1,095 P.O.E. West Coast. Its automobile-type chassis seats two, steers from the left, and



can turn in a 16-foot circle. The two-cycle, air-cooled engine delivers 65 miles per gallon. A pickup model with open body but closed cab lists at \$985.



A FOUR-DOOR VOLVO, the 122S has a front end radically different from the bustling one of the two-door model. A flat trunk line replaces the fast back. Fenders are gently finned. Mechanically the two models are the same. The 122S carries a price tag of \$2,795 for its 2,400 pounds.

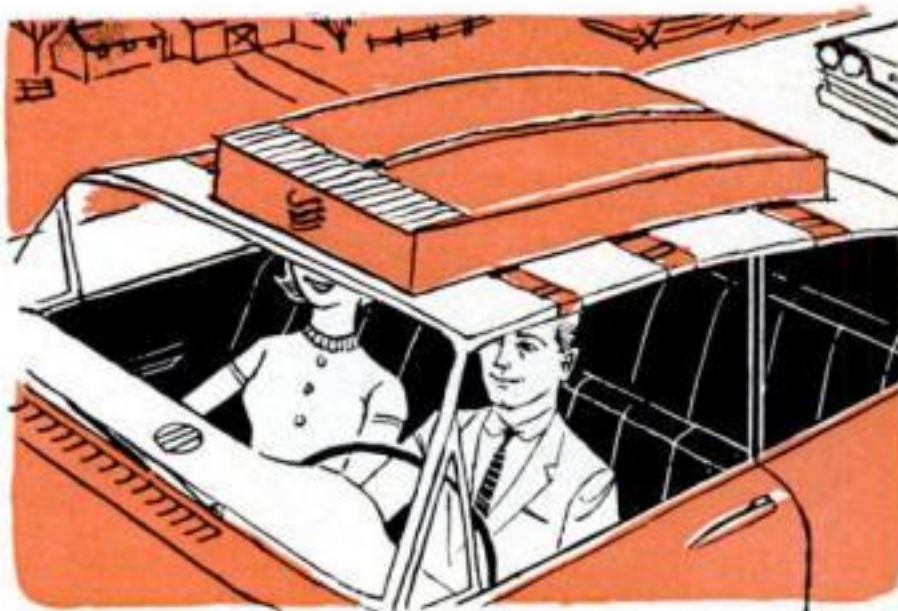


PRINCE: BIG CAR FROM JAPAN. On a 99.8-inch wheelbase, the Prince seats six in an overall length a few inches less than that of the Rambler and Lark. It comes with either 60- or 80-hp. engine, has a combination tray-and-backbone frame and De Dion independent rear swing axles.

"I'd like to see them make..."



HINGED ALUMINUM TENTS you could fold up for easy transporting. They'd be waterproof and rustproof and would reflect sun to make a cool shelter.—*R. Eschleman, Reading, Pa.*



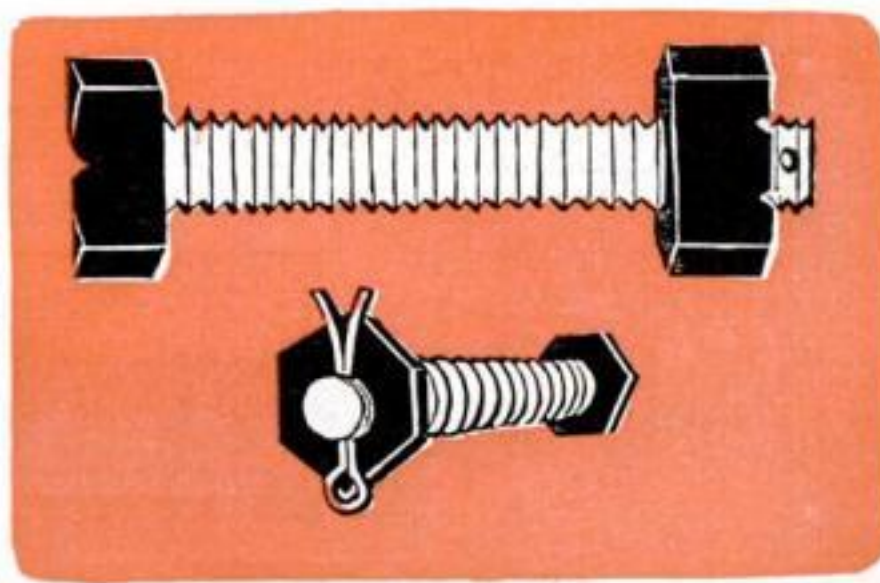
CAR-TOP GARMENT BAGS fitted with long straps that could be passed through the windows and buckled. Clothes hung inside a car cut visibility.—*F. M. Matthews, Millington, Tenn.*



ICE-STICK FREEZER TRAYS. Depressions the size of a carpenter's pencil would turn out ice shaped to slide through the neck of a small pop bottle.—*Phil Liston, Wooster, Ohio.*



A SAFETY LOCK FOR POWER WINDOWS on cars. An electrical switch, controlled by the driver, would cut off power when children were in the car.—*A. J. Dallaire, Opa Locka, Fla.*



HEAD MARKINGS on bolts that require cotter pins. With a notch in the same plane as the hole, even working blind you could slip the pin in with ease.—*G. Wilson, N. Guilford, Conn.*

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE readers. What's

yours? We will pay \$5 for each one published. Please use Government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

THE SEDANS:

300d

220S



Mercedes:



Germany's Royal Family of Cars

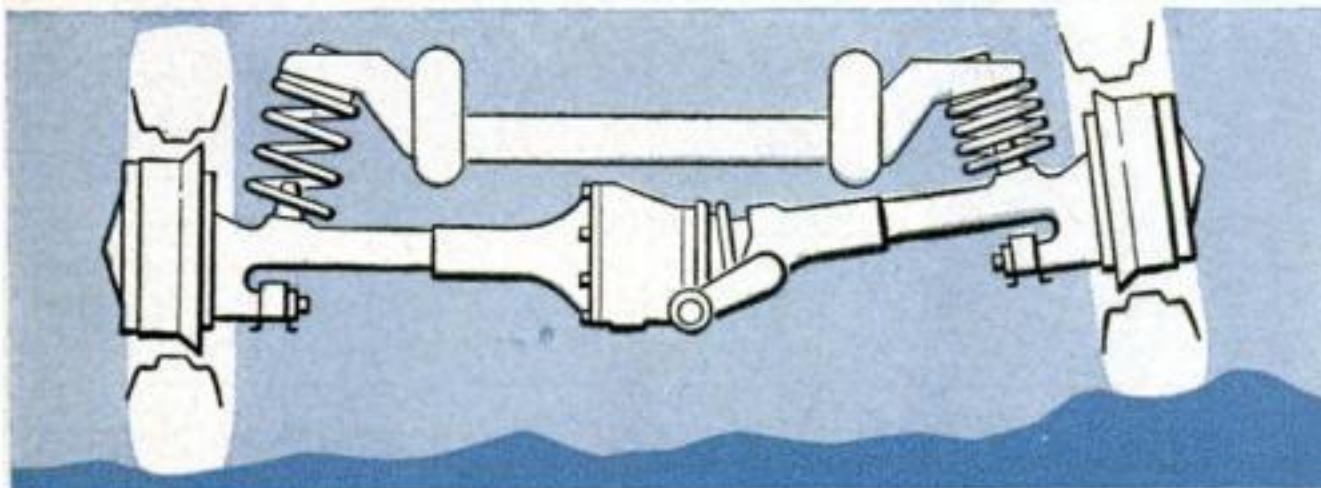
*Putting one of these chariots alongside a Detroit product
is like comparing a Rhine castle with a California bungalow*

By Devon Francis

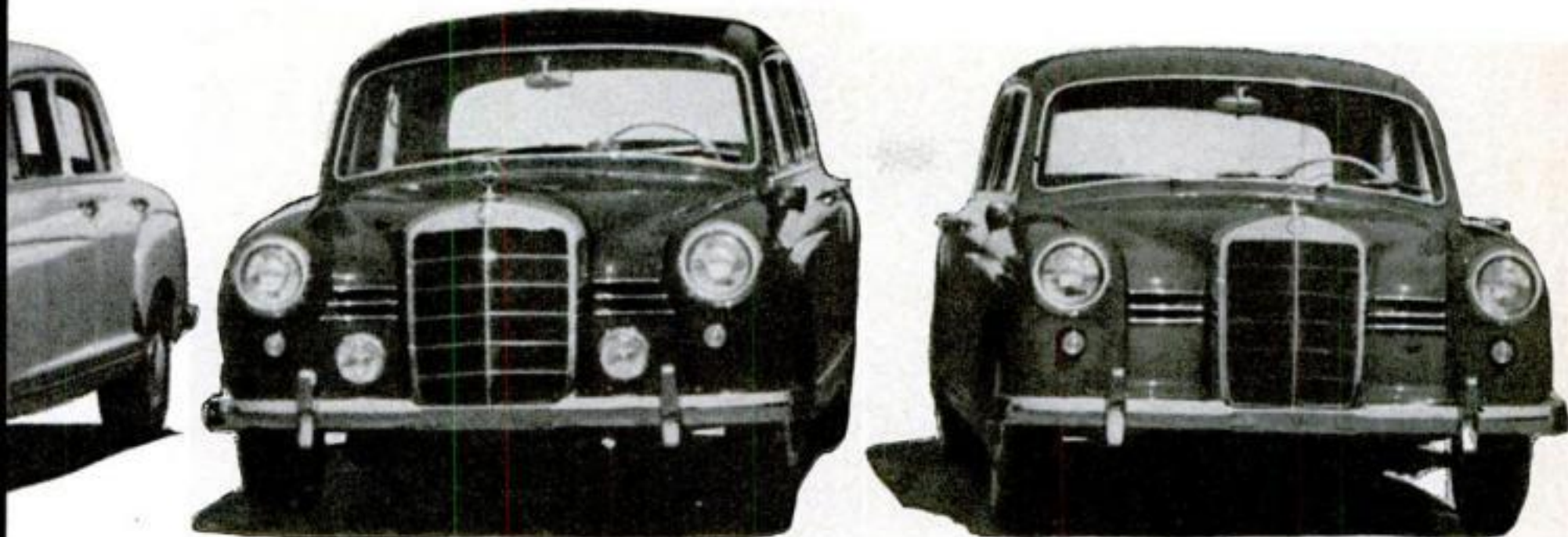
ONCE upon a time there was a girl, and she lived with her father in France. Her father loved her. One day a man came to their cottage and asked if his company, which manufactured automobiles in Germany, could name its machines after her. The father said yes, it could. And so it did.

Today there are hundreds of thousands of automobiles all over the world with the girl's name on them.

The girl's name was Mercedes, pronounced Mer-say-dis. Never mind her last name. It doesn't matter. The word Mercedes, immortalized in nuts and bolts, is synonymous now, almost 60 years later, with self-propelled vehicles manufactured with such skill and preci-



ALL MERCEDES CARS, including the competition-type 300 SL (for "super leicht," super light), have a hinged "swing axle" that, in effect, affords independent suspension for rear wheels.

190D**180**

sion that one will chug on and on, over African veldt or U. S. turnpike, practically forever.

The Mercedes-Benz family of cars is to the West German Republic what Rolls-Royce is to England or, indeed, what Gina Lollobrigida is to Italy. It is a natural resource. The Benz part of the firm made the world's first car powered with an internal-combustion engine. Barney Oldfield, the racer, drove a Benz more than 120 miles an hour clear back in 1910.

Mercedes cars come in all sorts of flavors. The prices range from sort-of-expensive to Wow! The least costly is

\$3,240, which figures out to \$1.26 a pound, and the most costly is \$11,375, or \$3.99 a pound. For comparison, a Chevrolet can be bought for 66 cents a pound, a Ford for 68 and a Plymouth for 69.

On the other hand, the Cadillac—with which our girl Mercedes is more properly bracketed—comes at \$1.05 a pound in its lowest-cost version.

In slowly increasing numbers, Mercedes cars are appearing on U. S. highways and byways. If you bought one of these machines in 1958, you were one of a mere 5,364 new Mercedes owners.

The elegant chariots. They are not, to begin with, like U. S. cars. Comparing

SEDAN GRILLES attach to the hood sheet metal and raise with it, as on this model 220 S sedan. Horsepowers run from 46 for a four-cylinder diesel to 240 for a six-cylinder gasoline engine with direct fuel injection. Pistons, cylinder heads, oil pans and manifolds are aluminum. Manufacture is so precise that pan is oil-tight without a gasket. Six cylinders of 220 S develop 120 hp. With port injection—designated by addition of letter "E" to model number—it has 130 hp.



THE SPORTS CARS



190 SL



300 SL

a Mercedes with a Detroit product is like putting a castle on the Rhine and a split-level California bungalow back to back. Mercedes sedan styling is from yesteryear, right down to the mud guards. Today's bodies are practically the same as they were in 1951.

The company really outdid itself in 1954—it flattened the trunk lid and put a curve on the windshield.

The more expensive sedans, such as the 220S, at \$4,283 a copy, have instrument panels in hand-rubbed walnut—from the Black Forest, of course.

Five of the 11 types of Mercedes sold here are, literally, hand-assembled. Everything has to be solid. Everything has to mesh. Chrome decorative strips,

for instance, are attached first to the raw sheet metal for snugness. Then they come off. The car is given two coats of primer and six finishing coats. When lacquer is used, each coat is hand-rubbed. Only when the body stands in its ultimate dazzling splendor are the chrome strips put on to stay.

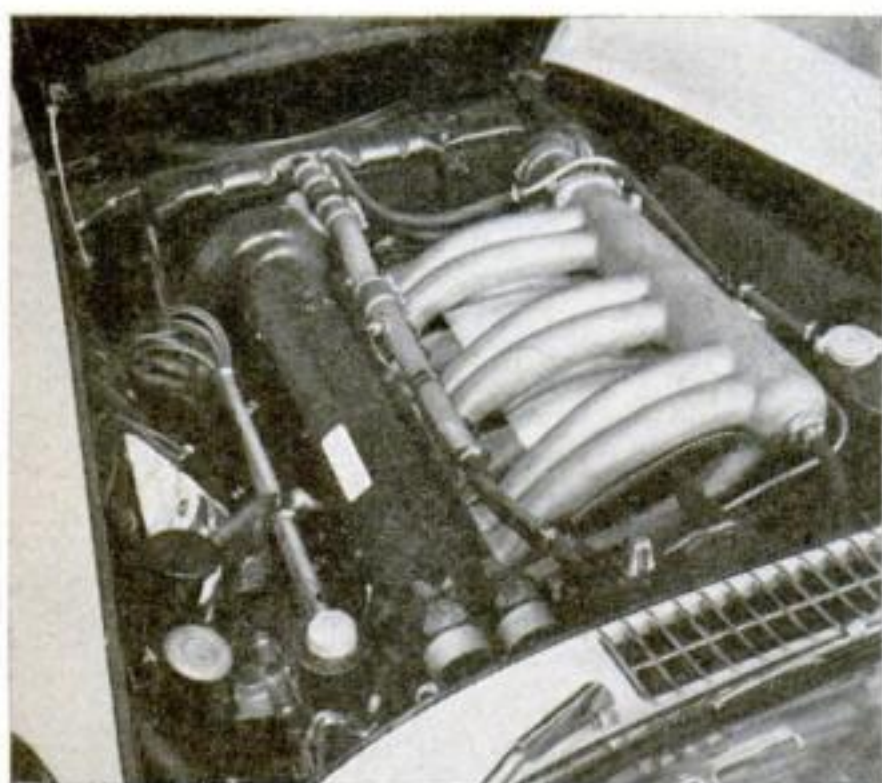
Mercedes does use some acrylic paints and enamels, like Detroit, which may be the first hint of approaching decadence.

Engines for the 300d sedan, the \$10,418 closed-car showpiece, and the \$11,375 300 SL competition sports car (which may well be the world's most exquisitely styled automobile) are assembled, run in, torn down, magnafluxed and finally reassembled lovingly, piece by piece, before installation in the car.

Interiors smack of the Hapsburg carriage. They run heavily to leathers. Door catch-all pouches are as capacious as a mama kangaroo's.

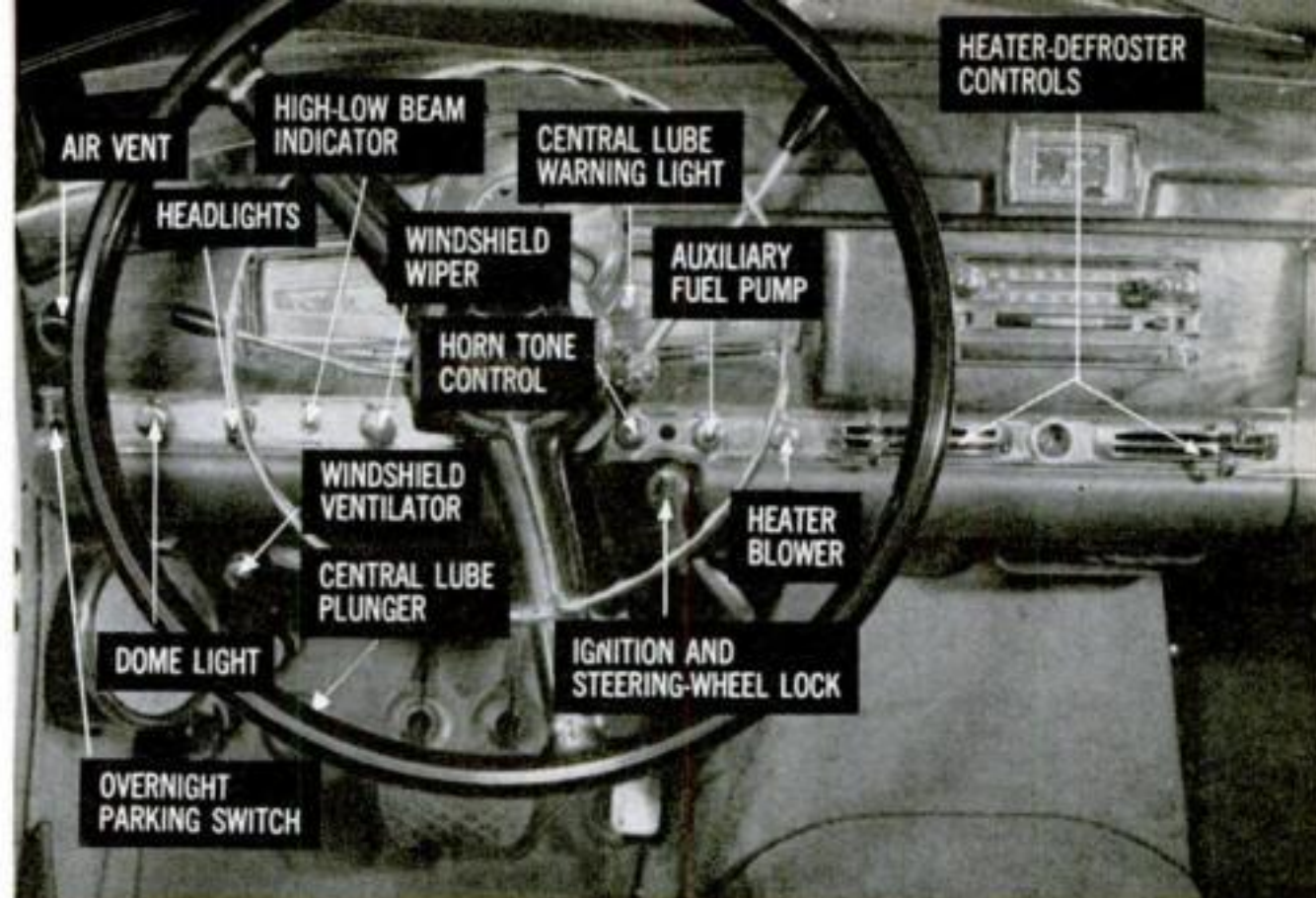
Chassis that don't bend. When you shut the door on a Mercedes sedan, it's like closing a bank vault. Body and frame are of unit construction; no squeaks, no rattles. To make sure that engine vibration is insulated from the body, engines are mounted on sub-frames, sandwiched with rubber. Rear axles are similarly insulated.

Little mechanical extras insure a smooth ride. The Mercedes people assume that the customer who is willing to part with several thousand dollars for a car is due his comfort. On the 300d the turn of a knob controls "supplemental springing" in the rear. This is a motor-actuated torsion bar to stiffen or



SAUCY, DIRECT-INJECTION ENGINE of 300 SL is tipped to left 40 degrees to lower center of gravity and achieve low hood line. Depending on axle ratio, car does 129 to 146 m.p.h.

CONTROLS A-PLENTY: In addition to customary instruments on this \$10,000 300d panel, there are 18 buttons and indicator lights. Vehicle is advertised unblushingly as "the touring car for the upper class." Mercedes engines want to be driven hard, are happiest above 5,000 r.p.m., begin balking below 2,000.



relax the suspension. Packard had a version of this in 1955 [PS, Feb. '55].

Axles bend. At one side of the differential, the rear axle is hinged to provide, in effect, independent rear springing.

Some Mercedes models come with front, or both front and rear, brake drums of aluminum lined with iron, and all but one model have brakes that adjust themselves for wear. Drums are finned for heat dissipation and fade resistance.

The miniature horses. The whoppingest engine that the Mercedes boasts—a six—displaces fewer cubic inches than the little Rambler American and is only a smidgen bigger than the Studebaker Lark's, the tiniest volume car engine produced in this country. The smallest Mercedes engine, a four, is less than half the size of the most modest Chevy, Ford or Plymouth engines.

There are only two basic Mercedes engines. The nine horsepowers offered are all from variations in displacement or the type of cylinder fueling.

These engines, for their size, develop quite a decent amount of power, especially in their fuel-injection versions. Overhead cams, with their tidier valve trains, no doubt help. The most popular Mercedes model—over here—the 220 S sedan, squeezes 120 horsepower out of a meager 133.9 cubic inches distributed among six carburetor-fueled cylinders. That's nine-tenths of a horsepower per cubic inch. The 300 SL produces almost 1 1/3 horsepower for each cubic inch.

The only engines produced in this country that can match that of the 220 S are the Cadillac Eldorado's at .89, the Chrysler 300E's at .92 and the De Soto Adventurer's at .91. We don't make anything that holds a candle to the 300 SL's.

But that's only part of the story. Like most European engines, all of Mercedes' are built to produce their power at exceptionally high speeds. Whereas some U. S. engines peak as low as 3,600 r.p.m. and most peak by 4,400 or 4,600, Mercedes

[Continued on page 222]

Mercedes Diesels Get 40 Miles Per Gallon as Taxis

TAXI owners in New York City are riding around town these days—as paying passengers—in Mercedes diesel hacks. They want to find out what this diesel business is all about. And eight taxi drivers, who skipper the things, are only too willing to tell them. First off, there's the fuel cost—22 cents a gallon as compared with 28 for gas. Then there's the miles-per-gallon—just about 40 as compared with eight to

14 for a gasoline engine. The first hackie to buy a diesel testifies that he has clocked about 40,000 miles. Total repairs: \$3. Diesel cabs in Germany are said to have gone as much as 500,000 miles—and are still going. Normal life of a New York cab is a third of that. A diesel hackie club meets in a midtown cafeteria. By early summer New York will have 18 more diesel taxis.



PICTURE WINDOW. This striking view of Diamond Head, Hawaii, is in the ballroom of the Cincinnati Music Hall. It's an Ektacolor photograph—80 feet long by 20 feet high—made by Color Corp. of America.



BIG TIME. A 60-foot electric clock to be installed on a building is shown here at a British exposition. It has a 30-foot minute hand moved by clockwork instead of by pendulum, is wound every hour by an electric motor started by a master clock.



HOT-DOG STAND. Here's a motor scooter equipped for peddling frankfurters. Lambretta has fitted it with a grill, compartments for franks and fixings, cold-drink ice box and a display case. For \$1,500, you can go into business.



TOE KEEPERS. These sheet-steel guards adjust on shoes like roller skates. They were invented by Gordon Wunker of Cincinnati to protect feet from the blades of a power mower. Cleats prevent slipping.



ATOMIC HEAD. One of the three missiles blasts off above from a ship in the Navy's Project Argus tests of the earth's magnetic fields. The nuclear bombs burst 300 miles above earth to spread a radiation blanket in outer space.

What Do You Know About Foreign Cars?

Under the modest bodies of imported economy cars are some surprising engineering twists. Can you pair these features with the right cars?

- 1.** An engine that has only seven moving parts—but more than one spark coil.
- 2.** Variable road clearance, so the body can ride higher to negotiate rutted roads or deep sand.
- 3.** A separate oil sump below the crankcase, where the air stream can cool it.
- 4.** A worm-and-gear differential drive, instead of the usual hypoid gears.
- 5.** Connecting rods with roller-bearing big ends, and a crankshaft running in ball bearings.
- 6.** A differential-less drive by V belts to both rear wheels, with automatic ratio shifting to suit the load.
- 7.** A two-cycle engine for which you do not mix oil with the gas.
- 8.** A magnetic clutch, held in engage-

ment by the generator output, that makes it impossible to stall the engine.

9. Preselective shifting, with which you choose the next gear, but which makes the shift only when you step on and release the clutch.

10. A fuel pump that has a diaphragm driven neither by mechanical linkage nor by electricity.

11. Built-in power jacking with which the car hoists up its own wheels.

12. An engine with dual carburetors, developing almost one horsepower per cubic inch of displacement.

Cars that have these features (some have more than one) are the Renault, DKW, Citroen, Saab, Peugeot, Simca, Goggomobil, Volvo and DAF. But which has which? For the answers, turn the page upside down.

-
- 7.** Goggomobil provides separate oil and gas tanks. A valve meters oil into the gas.
 - 8.** Renault offers the Ferlec clutch in both the Dauphine and the 4CV.
 - 9.** Goggomobil has a preselective gearshift. The lever is on the dash.
 - 10.** DKW powers its fuel pump by mounting it on one of its three gas-tight crankcase sections. The varying pressure in this as the engine runs actuates the diaphragm.
 - 11.** Citroen raises its own wheels, by means of the engine-powered suspension system, after the driver has placed a support under the body.
 - 12.** Volvo, with a displacement of 97 cu. in., develops 85 hp., or .88 hp. per cubic inch. The Mercedes does even better (see page 74).

- 1.** DKW has a three-cylinder, two-cycle engine with no valves, water pump, distributor shaft or gears—but three spark coils, each with its own set of breaker points.
- 2.** Citroen has an oil-air suspension system, powered by the engine, that permits altering road clearance from the driver's seat.
- 3.** Simca has a pressed-steel oil reservoir suspended below the crankcase.
- 4.** Peugeot lowers its drive shaft to the bottom of the differential by using a worm drive.
- 5.** Both Saab and DKW have three-cylinder, two-cycle engines with ball and roller bearings.
- 6.** DAF, made in Holland, shifts V-belt pulley flanges both to change the drive ratio and to provide differential action on turns.



WOMAN DRIVER: Patricia Jones not only light-footed her Dodge Coronet to victory in its own price class (Low-Medium) but squeezed out more m.p.g. than any other V-8 but Lark.

Dodge, Small Rambler Win Economy Laurels

AN INSIGNIFICANT figure, .6867, was cause for rejoicing among auto-company representatives in Kansas City, where the 1959 Mobilgas Economy Run ended. This was the difference between the 19.4396 average miles-per-gallon figure recorded by the 47-car field this year and the 18.7529 average for 1958.

To no one's astonishment, the little

Rambler American made top miles per gallon, but a Dodge Coronet V-8 covered itself with glory by outscoring all cars from the low-price V-8 class on up.

Auto men bragged that the higher m.p.g. average proved the 59s were thriftier, but there were a couple of hidden factors they preferred not to discuss. Compact cars in the Rambler-Lark class were permitted in the Economy Run

HIGH SCORE: Driver Woody Bell pinched 25-plus miles out of every gallon of gas that went

into this little Rambler American Deluxe—top mileage figure in the 1959 Economy Run.



again this year after being barred by a minimum-engine-displacement rule since 1956. A special class for low-priced sixes attracted a half-dozen six-cylinder entries—making the total nine sixes, including three in the Class A Compact Car group, against only two sixes in 1958.

On the other hand, the 1959 event was longer, rugger and more demanding than last year's. Drivers were forced to use heaters and defrosters—something virtually verboten in previous years—by cold, snowy weather on several sections of the run. Average speed for the 1,898.4 miles was pegged at 41.12 m.p.h., permitting no loafing along the way.

The route twisted from Los Angeles to Kansas City by way of Grand Junction and Denver, Col., and Lincoln and Omaha, Neb.—hitting 162 traffic lights and 147 towns along the way and rising to nearly 12,000 feet above sea level in Loveland Pass where Economy Run cars crossed the Continental Divide.

This makes the economy average look a bit better, despite the addition of more miserly compact cars and sixes.

If there is room for controversy over whether 1959 cars use less gas than 1958s, there is none about the question of gals in the event striking an impressive blow for the cause of the much maligned woman driver! They won in two of the six classes, would have taken three but for an accident that delayed Mary Davis and her Plymouth, costing her a 1.64-gallon penalty.

When a tie rod broke as her car hit a deep chuckhole, she ran five blocks to a Plymouth dealer for a replacement. None were in stock, so a car on the showroom floor was plundered. She scurried back and replaced the broken part by herself—rule is that drivers must make their own repairs—and was



AUXILIARY 21-GALLON TANK, mounted in trunk of each car, was used instead of regular tank. Leveling device (round object on top) was new this year, insured precise fuel measurement.

on her way in a matter of 38 minutes.

Elimination of the ton-mile formula cut down the number of makes that could claim victory. It used to be that almost every car could win in its class, confusing the public.—*Ken Fermoye*.

HOW THEY RAN IN 1959

(Listed in order of standing—first four cars only)

COMPACT CARS	Driver	Miles per Gallon
RAMBLER AMERICAN DELUXE	Woody Bell	25.2878
RAMBLER DELUXE SIX	Les Viland	22.9572
STUDEBAKER LARK DELUXE SIX	Bill Corey	22.4422
STUDEBAKER LARK REGAL EIGHT	Dick Griffith	22.2837
LOW-PRICE SIX CYLINDERS		
CHEVROLET BISCAYNE	Mary Hauser	22.3788
CHEVROLET BISCAYNE	Gus Retzlaff	21.9439
FORD CUSTOM 300	Danny Eames	20.3288
FORD CUSTOM 300	Ruth Doushness	19.9244
LOW-PRICE EIGHT CYLINDERS		
PLYMOUTH BELVEDERE	Pierce Venable	21.1548
PLYMOUTH BELVEDERE	Mary Davis	20.9880
FORD CUSTOM 300	Ak Miller	19.6698
FORD CUSTOM 300	Marian Lowe	19.4401
LOW-MEDIUM PRICE		
DODGE CORONET	Patricia Jones	21.7454
DODGE CORONET	Link Paola	21.0164
CHRYSLER WINDSOR	George Alsbury	19.6454
AMBASSADOR SUPER	Tommy Thomas	19.2266
UPPER-MEDIUM PRICE		
FORD THUNDERBIRD	Art Chrisman	19.1301
CHRYSLER SARATOGA	Mel Alsbury Sr.	19.0701
DE SOTO FIREDOME	Hart Fullerton	19.0632
FORD THUNDERBIRD	Loretta Colange	18.9949
HIGH PRICE		
CADILLAC 62	Jim Parkinson	19.0352
IMPERIAL CUSTOM	Mel Alsbury Jr.	18.2027
LINCOLN	Verne Houle	17.2739

Mighty spaceships to come will follow the trail to the moon and planets blazed by Pioneer IV, our first vehicle to escape from the earth

U.S. Super-Rockets On the Way

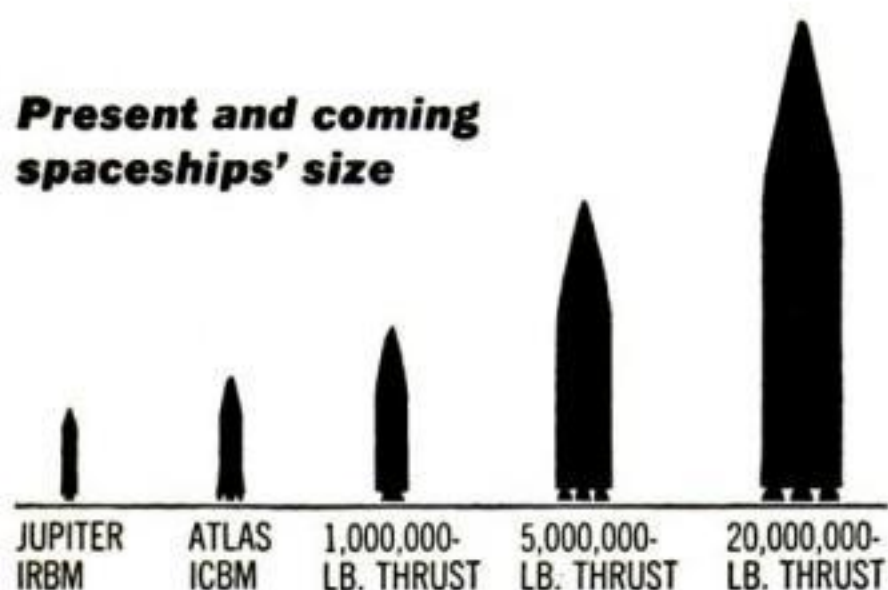
AN ATLAS ICBM will be merely the second stage of U. S. super-rockets coming up. Their first stage will be an engine of more than million-pound thrust. One of two versions under development, the Army's, will combine eight Atlas-style engines of 150,000 pounds' thrust apiece. A giant single-nozzle Rocketdyne version will follow.

In further steps foreseen by T. F. Dixon, Rocketdyne's chief engineer, a cluster of these engines will yield a 5,000,000-pound-thrust booster; next will come a single 5,000,000-pound-thrust engine; then, a cluster of these, with the fantastic thrust of 20,000,000 pounds.

Built at their launching sites like great liners, the resulting spaceships will implement bold U. S. plans: to put radios and telescopes on the moon, to send

men there within a decade, to probe near and distant planets. On ever-increasing scale the ventures will progress beyond our first success in sending a vehicle beyond reach of the earth's gravity—our Pioneer IV space probe, pictured opposite. What's coming next is shown on the reverse side.

Present and coming spaceships' size



Our First Man-Made Planet in Actual Size

NEWLY ornamenting the solar system is a piece of man-made jewelry, our Pioneer IV space probe. The golden cone, with black stripes, has become the first U. S.-launched object to escape the earth's gravity, and belie the adage that what goes up must come down.

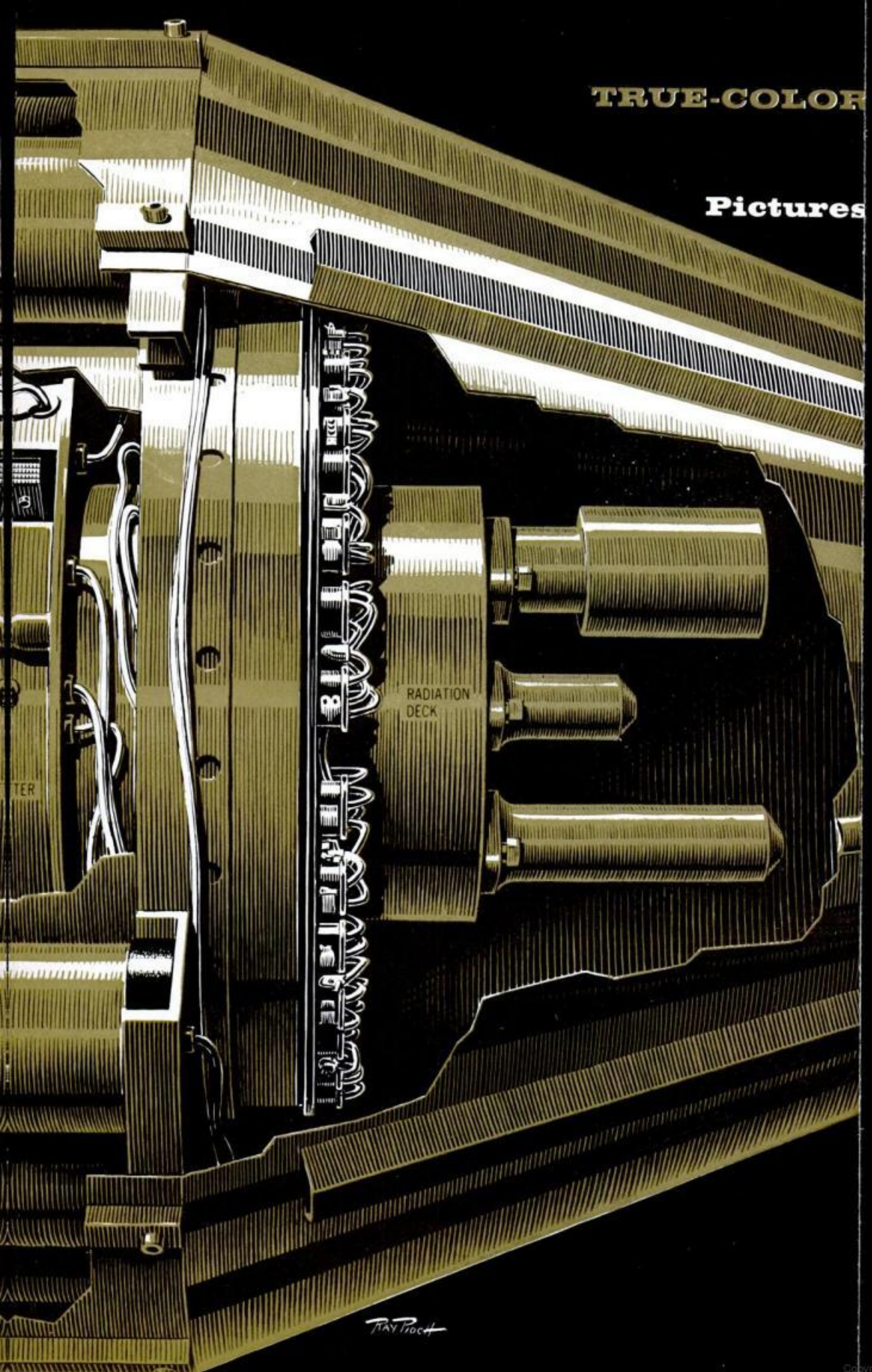
Borne into space by a four-stage rocket vehicle from Cape Canaveral in Florida last March, Pioneer IV now circles the sun as the planets do, in an orbit weaving back and forth across that of Earth. For eons to come, it will be an artificial planetoid—like the Russians' Mechta, a two-foot-diameter globe of stainless-steel segments alternately painted black and white, which attained a similar orbit last January.

While Pioneer IV was outward bound, its radio transmitted the best measurements ever made of the newfound and perilous radiation belts beyond the earth—and was heard as far as 410,000 miles away, a new distance record for messages from space. The cone's striped pattern, by absorbing just enough heat from the sun's rays and reflecting the rest away, kept instruments and radio at the right temperature during the transmitter's brief but fruitful life.



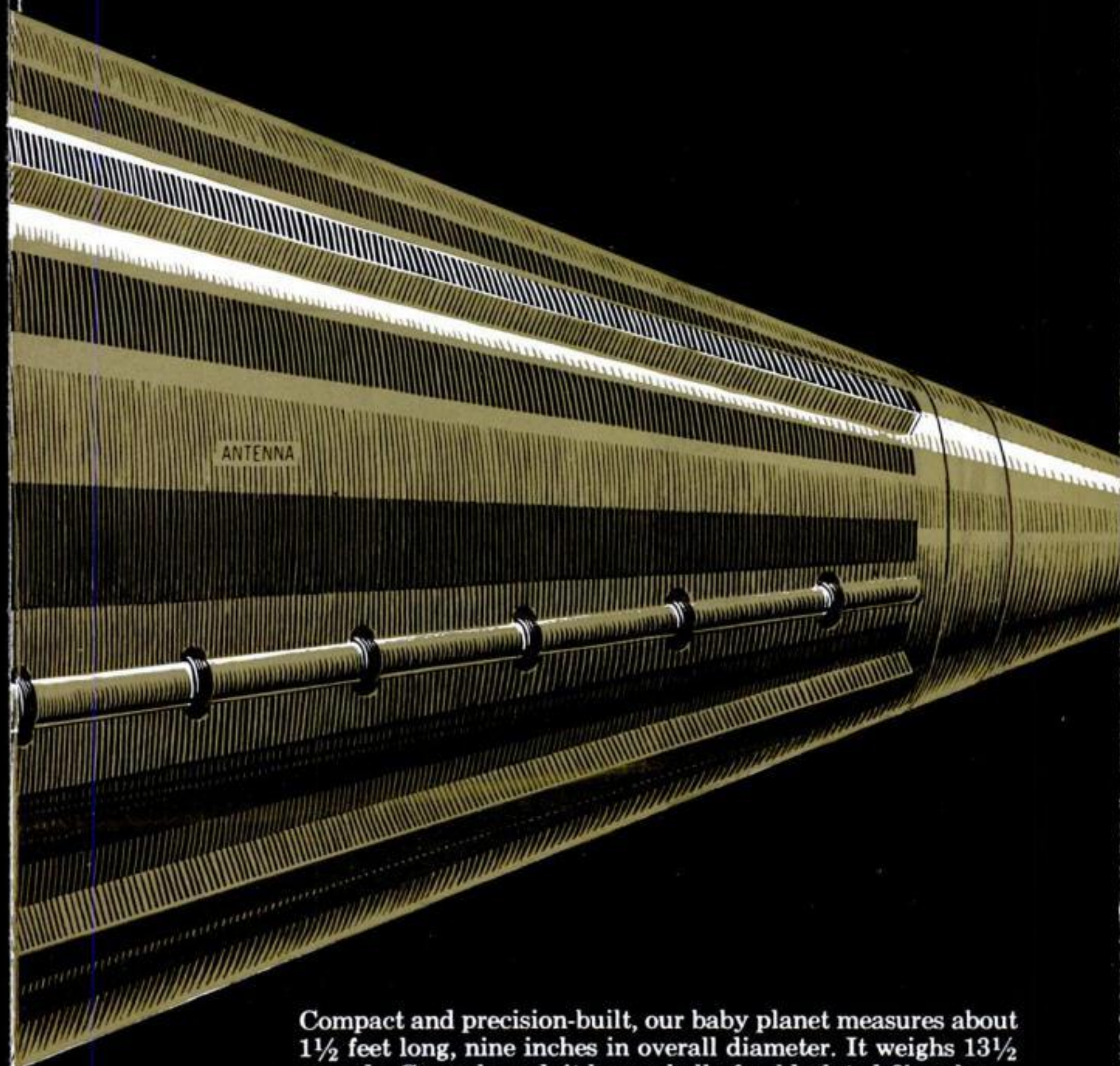
TRUE-COLOR

Pictures



RAY PROCH

PORTRAIT of artificial planetoid
shows its design inside and out.
at right tell how it reached
needed speed to leave earth forever



Compact and precision-built, our baby planet measures about 1½ feet long, nine inches in overall diameter. It weighs 13½ pounds. Cone-shaped, it has a shell of gold-plated fiberglass—which, during the batteries' life, served as its radio antenna. Inside are instruments for measuring high-intensity radiation in space; and a tiny but far-ranging transmitter, which reported the readings to earth. Protruding at rear is the "eye" of an optical trigger—which went untested because Pioneer IV passed wide of the moon—such as may trip future space-borne cameras for photographs of the lunar surface.

Pioneer IV's four-stage Juno II launching vehicle rose vertically, arced to inclined course. First stage, shown dropping away at burn-out, was Army's big Jupiter IRBM, modified to carry extra fuel.

1



2



Upper-stage assembly, in rotating "tub," coasted on and shed its protective nose shroud. Small rockets kicked the discarded shroud sideward, out of way.

3



Second stage, a cluster of 11 solid-fuel Sergeant rockets, then ignited and accelerated the payload skyward. The spinning tub, having served its purpose, fell away.

4



Third stage, of three more Sergeant rockets, gave the speeding payload its next upward boost. The spent second stage was left behind, to fall back toward earth.

5



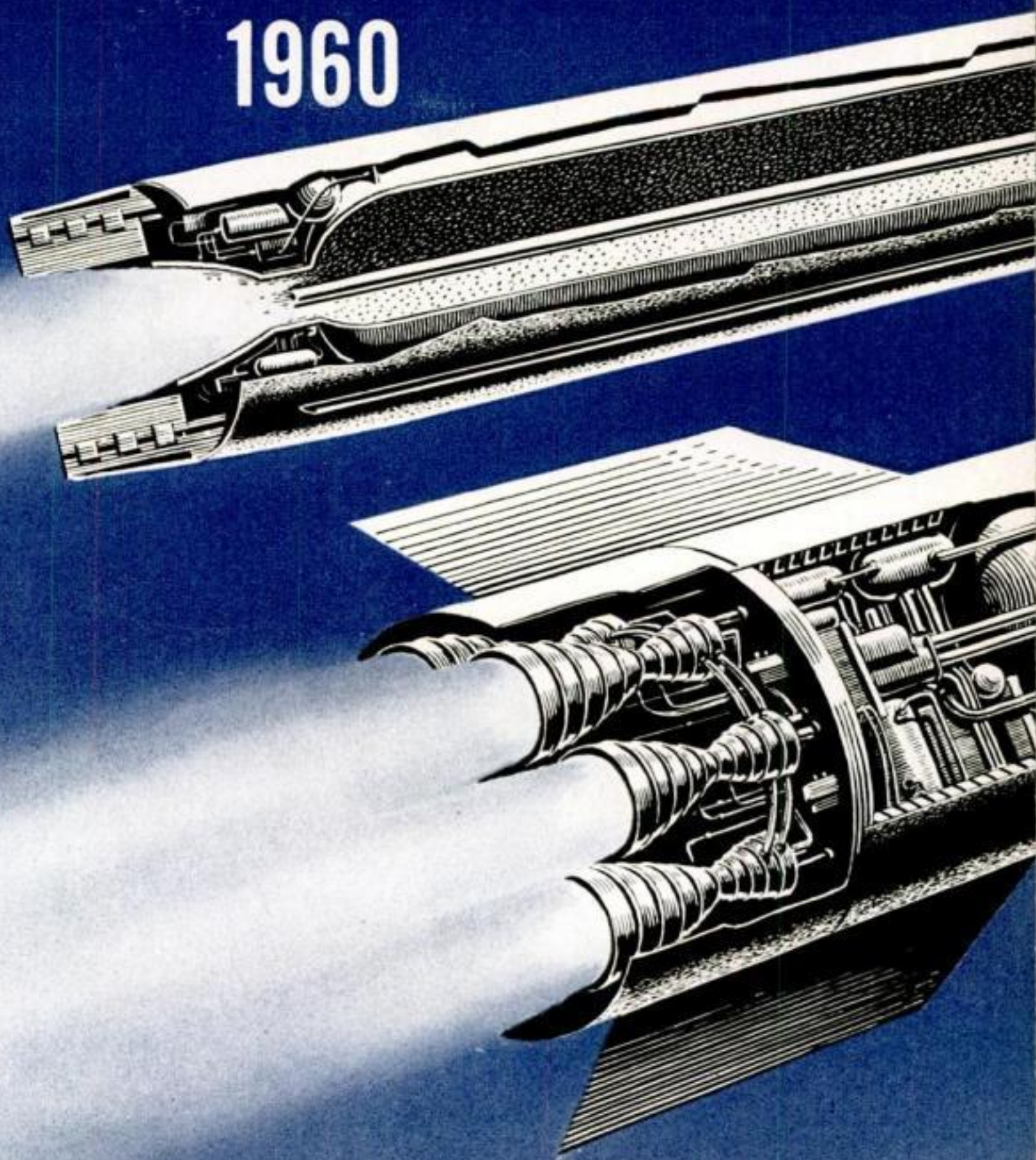
Fourth and final stage, a single solid-fuel rocket with Pioneer IV probe at its nose, made the successful dash that reached "escape velocity" of nearly 25,000 miles an hour.

6



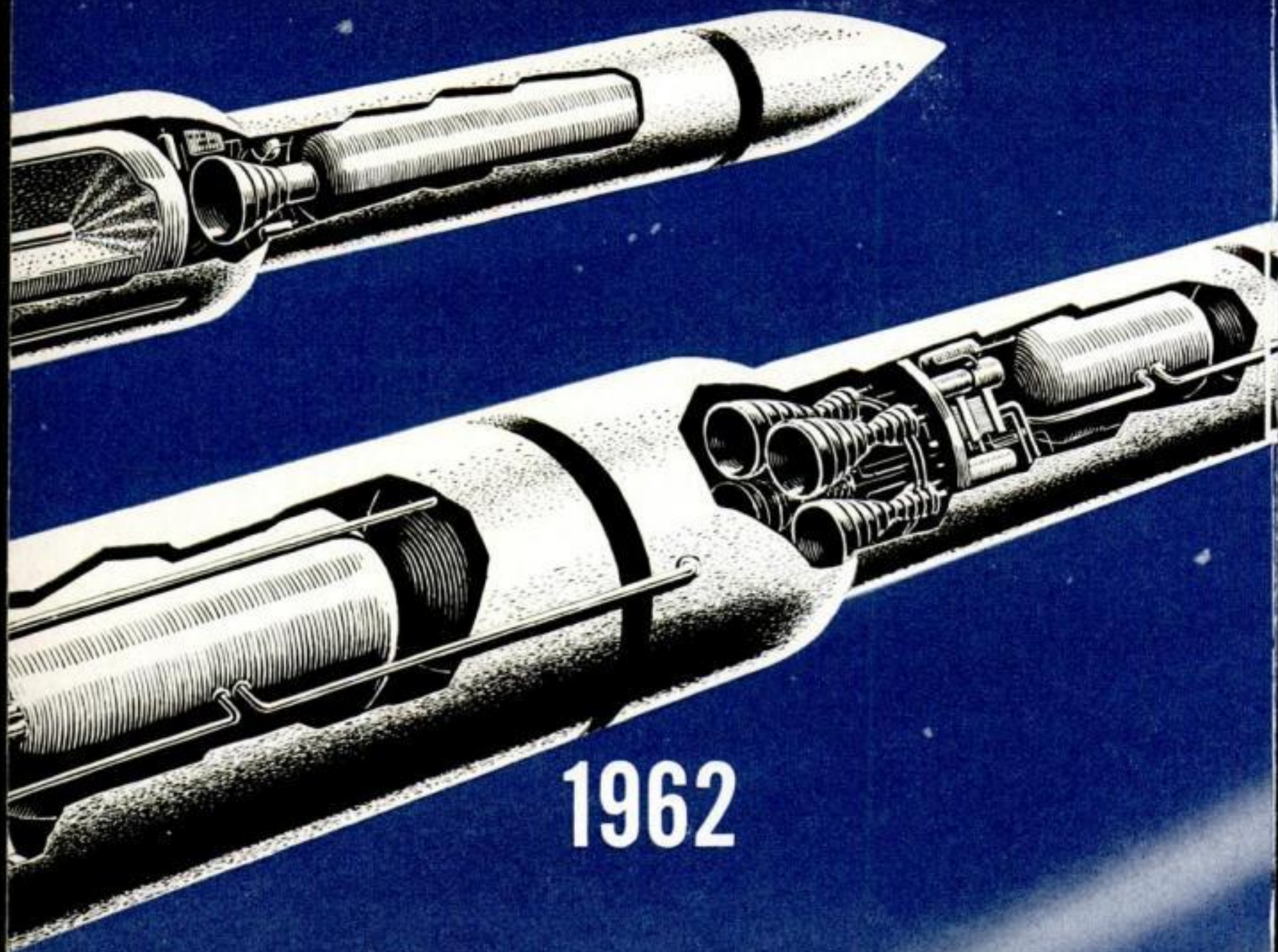
Pioneer IV probe discarded spent rocket (note clamp flying apart) to uncover "eye" that was to sight moon. But probe passed too wide of moon for the test, on its way to solar orbit.

1960



The Coming Fleet of U.

WHAT'S ahead in our space plans—and when—is pictured in these drawings, based on Rocketdyne engineers' generalized conceptions. Big solid-fueled rockets like the 35,000-pound "Scout," due by mid-1960, will multiply our pioneering astronautical ventures by moderating their present high cost. Outstanding longer-range development will be of enormous spaceships with rocket engines of unprecedented power. By 1962, a current project should yield a "clustered" rocket engine of 1,500,000 pounds' thrust, for the booster or first stage of the Army's monster "Saturn" rocket, which will be capable of such mis-



S. Spaceships

sions as stockpiling cargo on the moon for future lunar colonists. Next step, a single-chamber rocket engine of equal power, is expected by 1970 to lead to a multi-nozzle, 6,000,000-pound-thrust "clustered" booster (lower view), as for a great NASA "Vega" rocket. Also by 1970 (upper view), experimenters hope to perfect a low-thrust but long-lived ion-propulsion engine to propel a spaceship's upper stage on far voyages in the solar system. Nuclear rockets, powered by uranium-fueled atomic reactors, and applicable as boosters, upper stages, or both, should be ready by 1975 to carry the greatest space payloads of all.



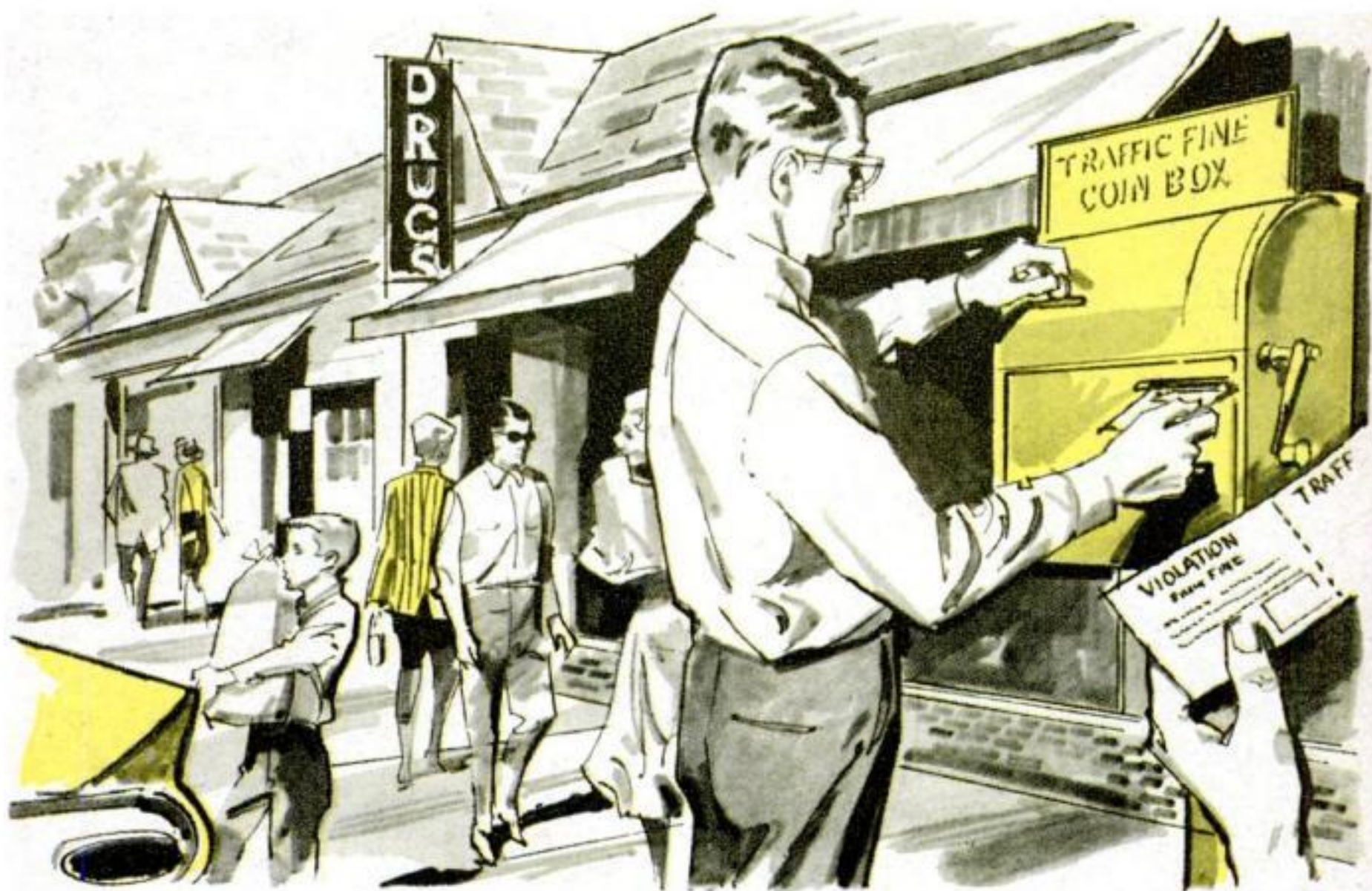
1970



1975

New Ideas from the Inventors

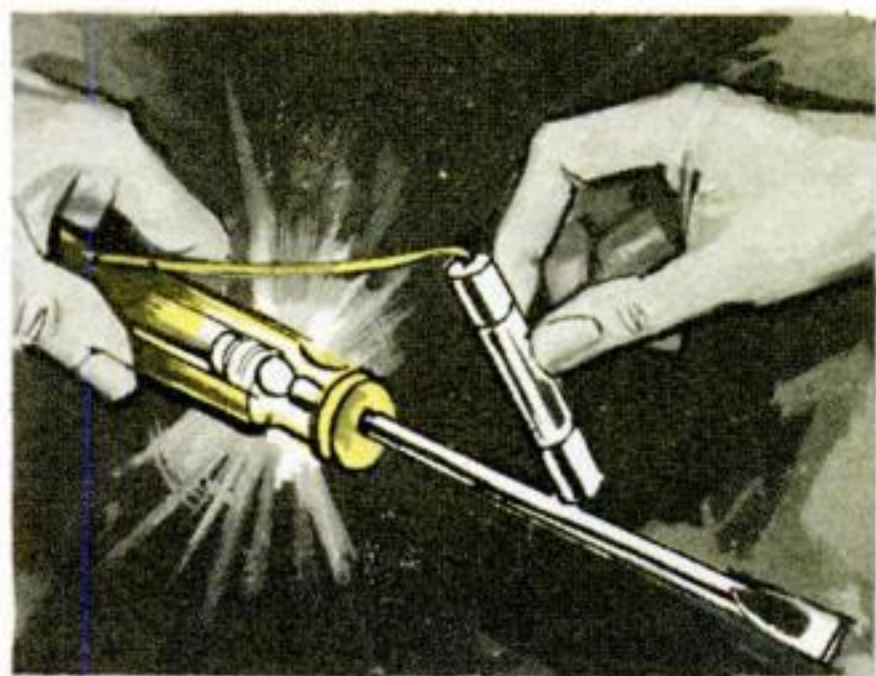
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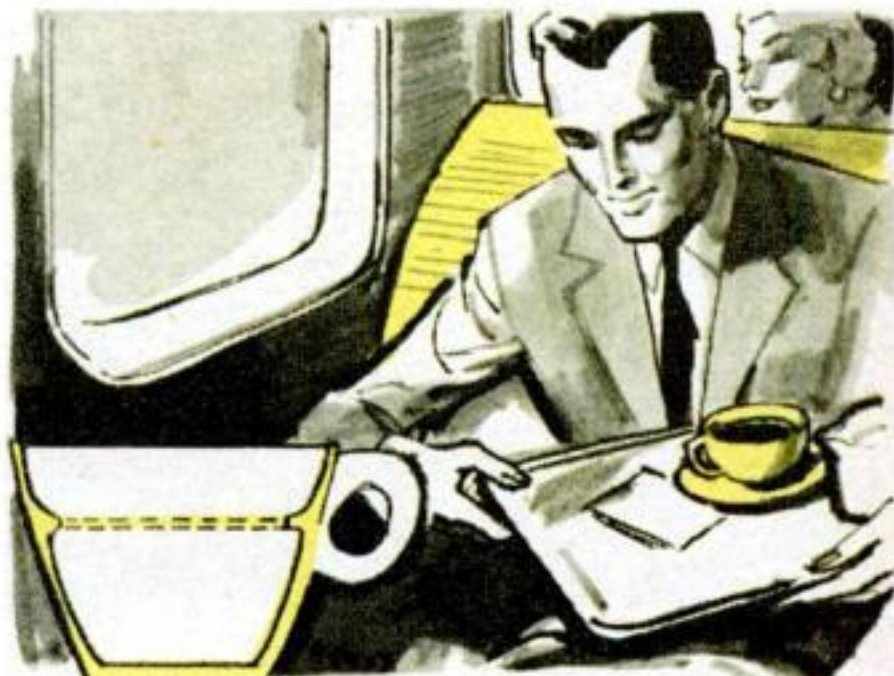
1 Box Collects Traffic Fines. A recently patented mechanical collector would let you pay your penalty for overtime parking or other minor violation without

standing in line at City Hall. On insertion of your ticket—with the right amount of coins—the box would record payment and return a receipted stub.

2 Screwdriver Tests Circuits. With this screwdriver you could quickly check fuses, lamps and other electrical parts and circuits as you work. A bulb, battery and test lead in the handle would show continuity when a unit, such as the fuse here, was inserted between lead and shaft.



3 Cup Rim Controls Splash. Train, plane and ship passengers—and even hasty, stand-up breakfasters—should suffer fewer coffee spills with beverages served in anti-splash cups like this. A built-in baffle ring would tend to deflect liquid that surged up the cup's sides.



Please turn the page for more new ideas

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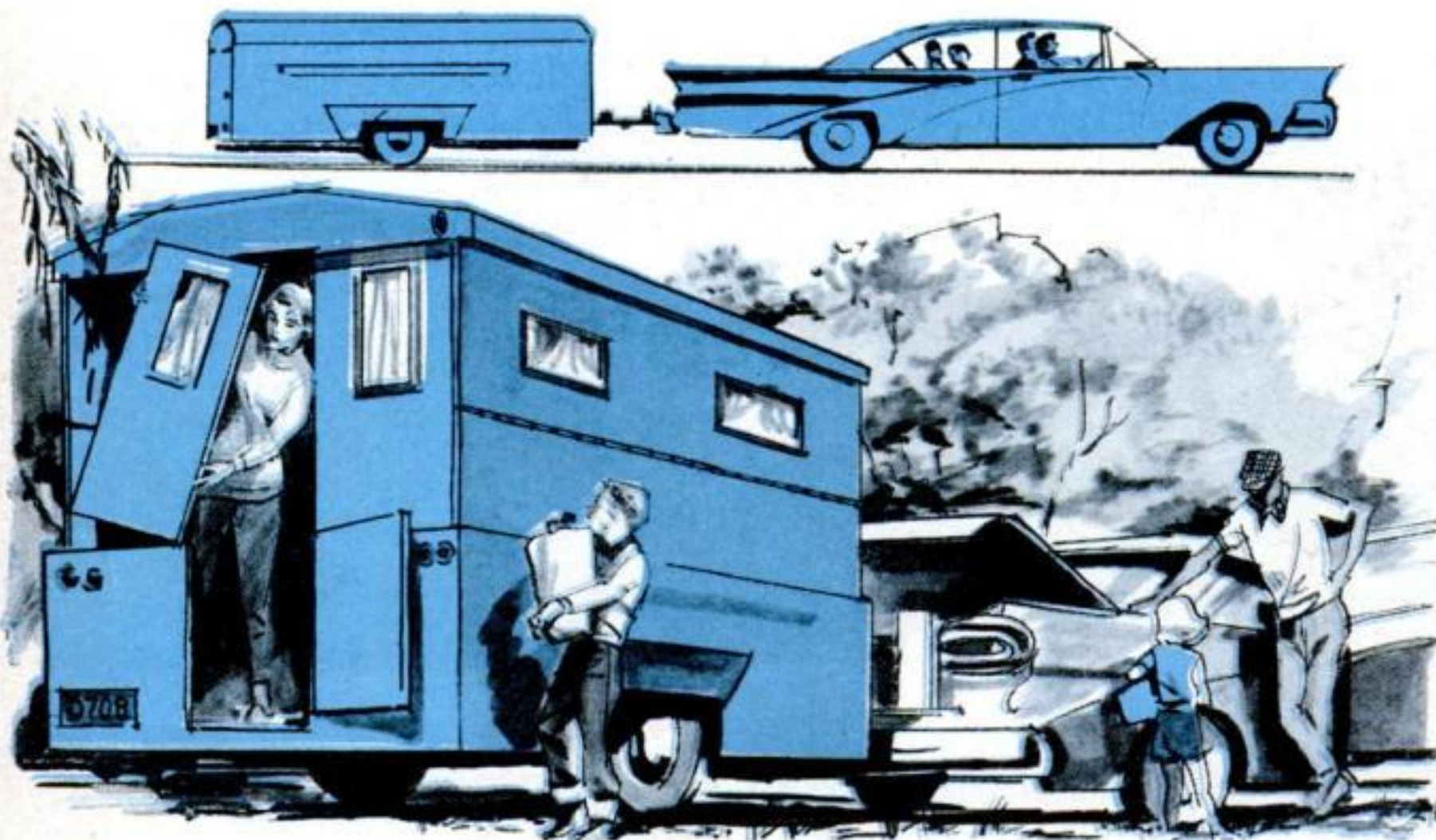
4 Slides Keep Baby Covered. An infant couldn't get tangled in blankets that were ring-fastened to slanting side rails on this crib (or on a separate insert frame). And if he kicked them off, they'd automatically re-cover him. Pins or ribbon ties would hold the blanket to the rings.



5 Double-Purpose Shoe Tree. You'd have no trouble slipping into shoes kept in shape by stretchers like this. Part of the hinged center arm would form a shoehorn. When you removed the tree to put on the shoe, you'd just fold it over to use the always-at-hand shoehorn.

6 Trailer Folds for Better Ride. With its top lowered, you could tow this collapsible trailer faster and more safely on turnpikes or mountain trails, clear any

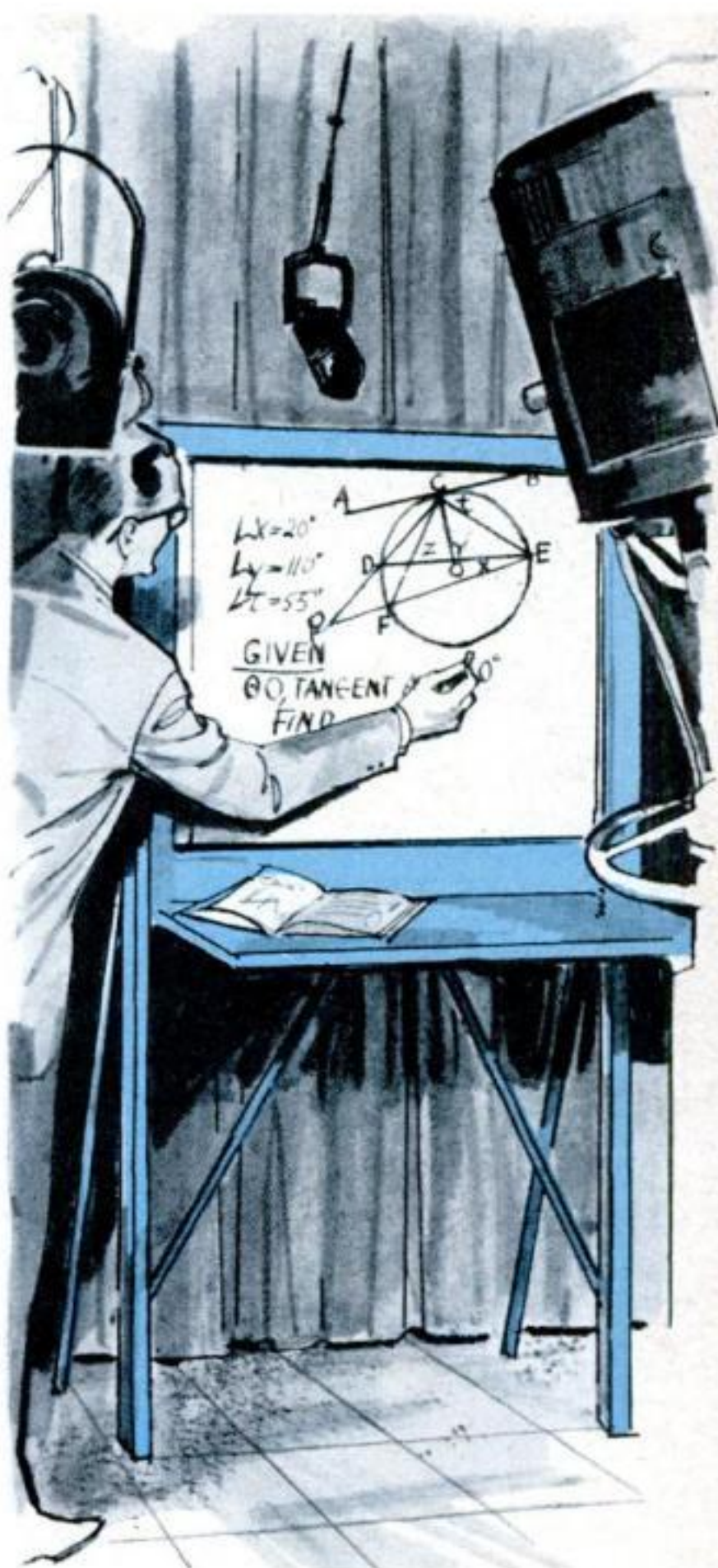
underpass that has enough headroom for your car and even garage it indoors. Hinged sides would fold in when front and rear panels were removed.





7 Marker Pinpoints Car. You'd have less searching to find your car in a busy parking lot if an owner's "flag" on the antenna marked it. The triangular plastic flag would furl itself when the car was in motion; a hinged hook would hold it open when the car was parked.

8 Mixer Fitting Sharpens Knives. With this grinding-wheel attachment slipped onto the driving shafts of a kitchen mixer, you'd just move knives or scissors along preformed slots to sharpen and hollow-grind their blades. Knives would be positioned by a narrow slot on one side of the housing, scissors by a wider slot on the opposite end.



9 Paper Roll Speeds Chalk Talk. TV teachers might cover more ground in less time (and simplify camera work) by using the wind-up paper roll on this lecture tablet for blackboard demonstrations. It would eliminate erasing, permit more advance preparation and simplify the review of previous lessons.

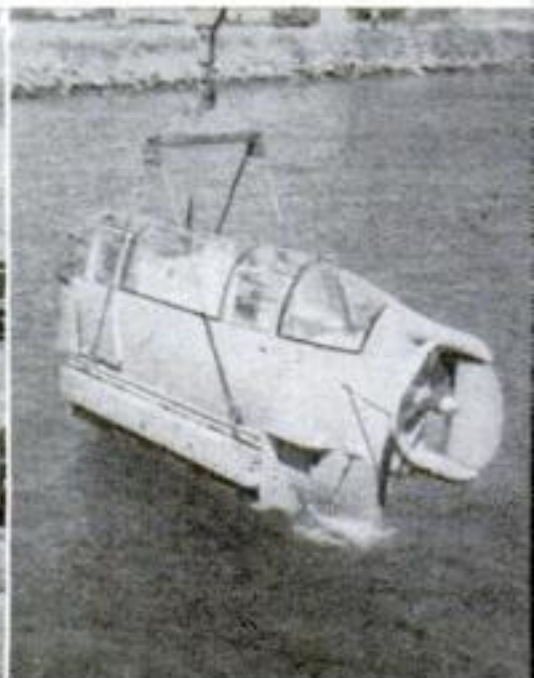
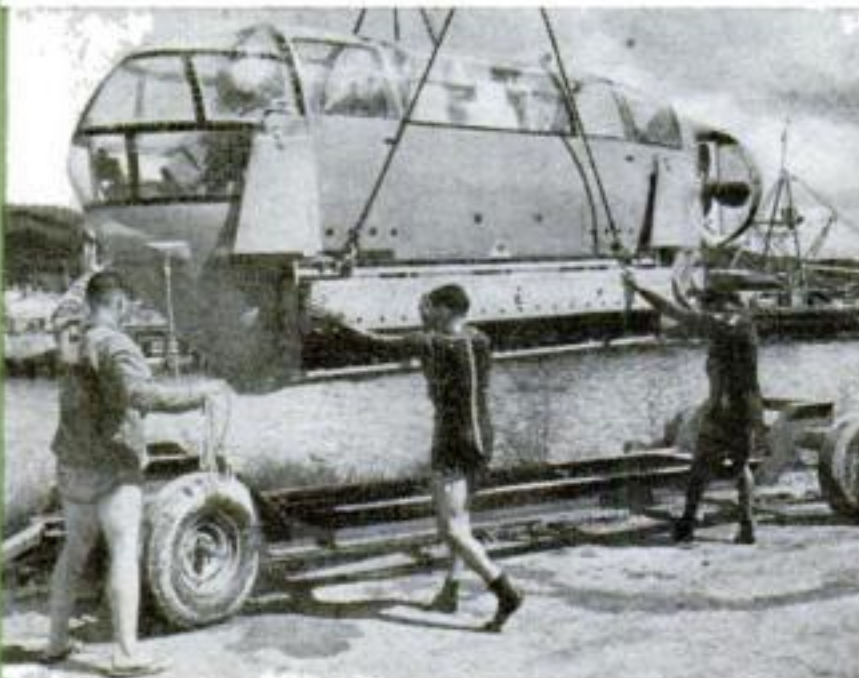
The following patents have been issued on these inventions: 1. Patent No. 2,860,752 to N. E. Moxley, Ellicott City, Md.; 2. No. 2,687,509 to S. L. Lewis, Dover, N. H.; 3. No. 2,858,041 to C. S. Robinson, Englewood, N. J.; 4. No. 2,838,770 to J. A. Chezem, Sarasota, Fla.; 5. No. D 178,828 to K. Contradi, Lattintown, N. Y.; 6. No. 2,729,497 to A. A. Runyan, Gashland, Mo.; 7. No. 2,858,793 to C. M. Palmer, Los Angeles; 8. No. 2,758,431 to G. E. Kaufman, Canton, Ohio; 9. No. 2,840,940 to J. R. Miles, Williamsport, Md.

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D. C., at 25 cents each. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.



Navy's New Undersea Hit-and-Run Raider

NAVY'S TWO-MAN SUB arrives dockside at St. Thomas, Virgin Islands, above, and launching crane hooks on; frogmen, right, help guide the miniature submarine from dolly for swing into the water; far right, the minisub is ready for boarding by its two-man crew and a trial run in the Caribbean's depths.



Handling the Aquabat is like flying a plane. But this two-man sub lands at the sea bottom for its deadly work

By Frank Harvey

TIME was when you could anchor your aircraft carrier inside some landlocked harbor, string anti-sub nets, plant a flock of mines and take off for the officers' club without a care in the world. When the liberty boat brought you back in the morning, the old flat top would still be there, safe and sound.

Those cozy times are now gone forever—at least for naval enemies of the U.S. The Navy's newest gadget, a deadly little two-man submarine known as the Aquabat, can sneak past sub nets and mines, and—with an atomic kill charge, if necessary—blow a mighty carrier out of the water like a bug.

The Aquabat handles very much like a light plane. I sat in one at Navy winter training quarters for frogmen, St. Thomas, Virgin Islands, and was given a complete "flying" lesson by Frank Moncrief, Underwater Demolition Specialist, who

was piloting the tiny giant-killer on her shakedown cruise.

"We've toyed with minisubs before, as you probably know," Moncrief said. "But they were Model T variety. You had to foot-pedal them, and by the time you got where you were going, you were as pooped as if you'd swum there in open water."

Moncrief tapped the control stick of the Aquabat lovingly.

"This baby," he said, "is a Cadillac. Four doors, full dual controls, high-powered batteries, every instrument you could wish, plenty of speed and range."

"How about weapons?"

"Yeah," Moncrief said, "she's got weapons that would turn any surface skipper's hair white as cotton. Don't ask me the details."

Moncrief then climbed into the rear seat of the Aquabat, which was on its dolly in the hangar, and I climbed into the front seat. We slipped into frogmen's masks and held our check-out confab



FROGMEN guide the Aqua-bat out of the launching cradle (above). Man on right opens the door of front pilot's seat from which he will steer. At right, the sub begins its dive. Pilot, at controls, is already underwater. Co-pilot, in rear, turns to give last look at daylight before he too goes under.





With an Aquabat, frogmen can sneak past nets and mines,

Any sort of ship, an innocent-looking rowboat or a submerged mother submarine can launch the Aquabat.



To dive, the pilot floods ballast tanks—just enough to make the ride steady.

Parked on the ocean floor, the two crewmen adjust portable air tanks on their backs.



over an intercom, just as if we were in an airplane. Moncrief's voice was wonderfully clear. He said it comes through just as well underwater.

The Aquabat, developed during the past three years by the Special Devices Group of the Navy's Underwater Sound Laboratory, at New London, Conn., is substantially bigger than any of its pred-

ecessors. It's 20 feet long, 6½ feet high and three feet wide.

It can be dropped miles from its target by any sort of surface ship, Moncrief told me. Even an innocent-looking rowboat with an outboard motor can tow it. Or it can swim off the back of a submerged mother sub.

Made largely of aluminum, it does not attract magnetic mines. Its full Plexiglas canopy gives both crew members an all-around view of the watery landscape. This helps them to avoid hitting coral heads and makes it easier to see an underwater target.

For most of every journey submerged, the Aquabat finds its way by compass and depth gauge. These are located in both the forward and after cockpits.

Each cockpit has two control sticks, mounted side by side about six inches apart. The left one moves the bow planes, the right one the stern planes. For fancy maneuvering (or faster diving) they are operated individually. But for normal cruising they are lashed together with a top clip. Duplicate sets of controls enable either crewman to take over.

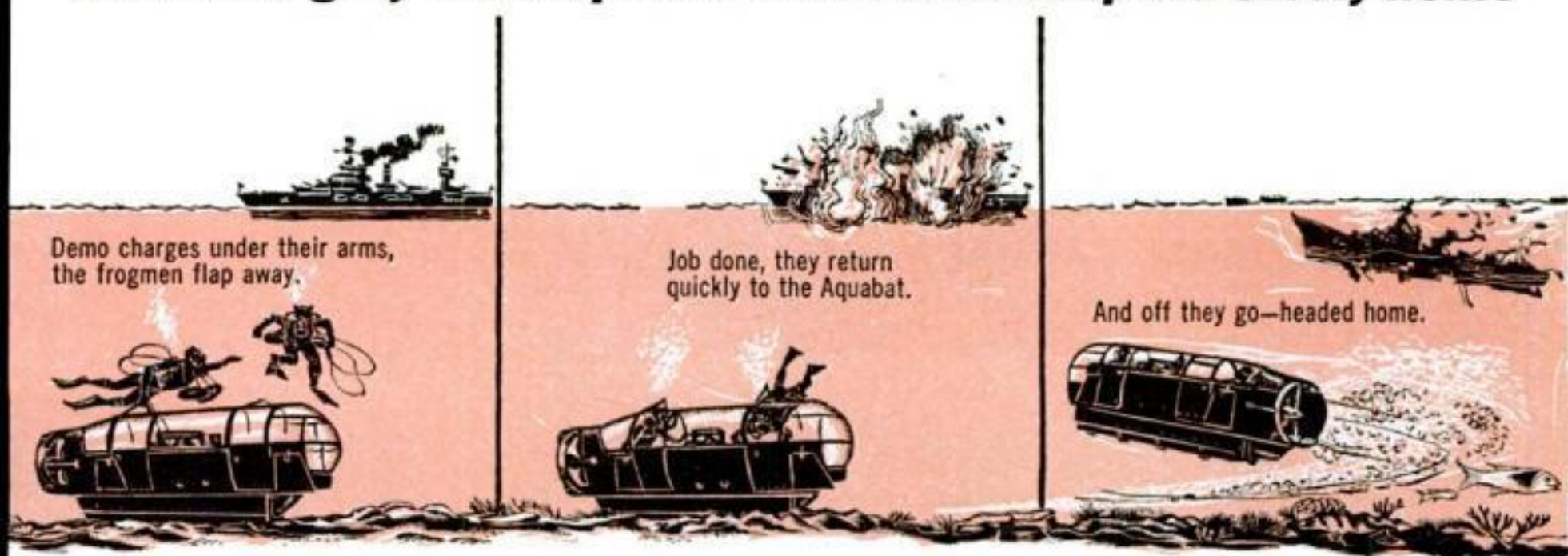
As the Aquabat submerges, water automatically fills it, flooding in through holes at the bottoms of the doors. So the crewmen must always be in diving masks. For the trip from mother ship to target area and back, they breathe air from the sub's own tanks. When they are ready to leave their little ship to do a demolition job, they plug in to the air tanks on their backs. Making the switch underwater entails hair-raising risks.

To dive the Aquabat, I learned, the man at the controls first floods ballast tanks to give it neutral buoyancy—just



TEST PILOT of the Aquabat is Frank Moncrief, Navy frogman, shown in front cockpit with diving mask and intercom. Left control stick works the bow planes; right one, the stern planes.

send a mighty warship to the bottom and speed safely home



enough to make it ride steady at the depth he wants. Then he simply pushes the stick forward, as in a light plane. The diving planes tilt and the sub noses down. To level her, he pulls back on the stick and trims for neutral buoyancy at the new depth. (The ship must now be heavier, of course, to stay down.)

If the Aquabat should ram a mudbank (and the crewmen wear safety belts to hold them in place in case of such an emergency), its pilot can get the little vessel unstuck by forcing water out of the ballast tanks with compressed air, with propeller reversed.

Parking on the bottom. When the sub has traveled, at a smart five or six knots an hour, to the spot it's headed for, the pilot floods a big tank in its belly, and the ship sinks to the bottom. There it lies, like a heavy stone, while the crewmen flap off with their demo charges under their arms.

If an accident should jam the doors shut, either crewman can easily escape from his cockpit by standing up and shoving his head and shoulders against the canopy. This forces pop-out panels to give way and clear an escape opening.

When the crewmen are ready to head for home, one of them blows out the ballast tanks to give the ship positive buoyancy, then pulls back on the stick, and off and up they go.

"How long does it take to learn to fly this bird underwater?" I asked Moncrief. "I heard the foot-pedal job was so simple anybody could master it in half an hour."

"This one isn't that simple. It takes a lot longer than half an hour to get the hang of it. But she does so much more that the extra trouble is worth it."

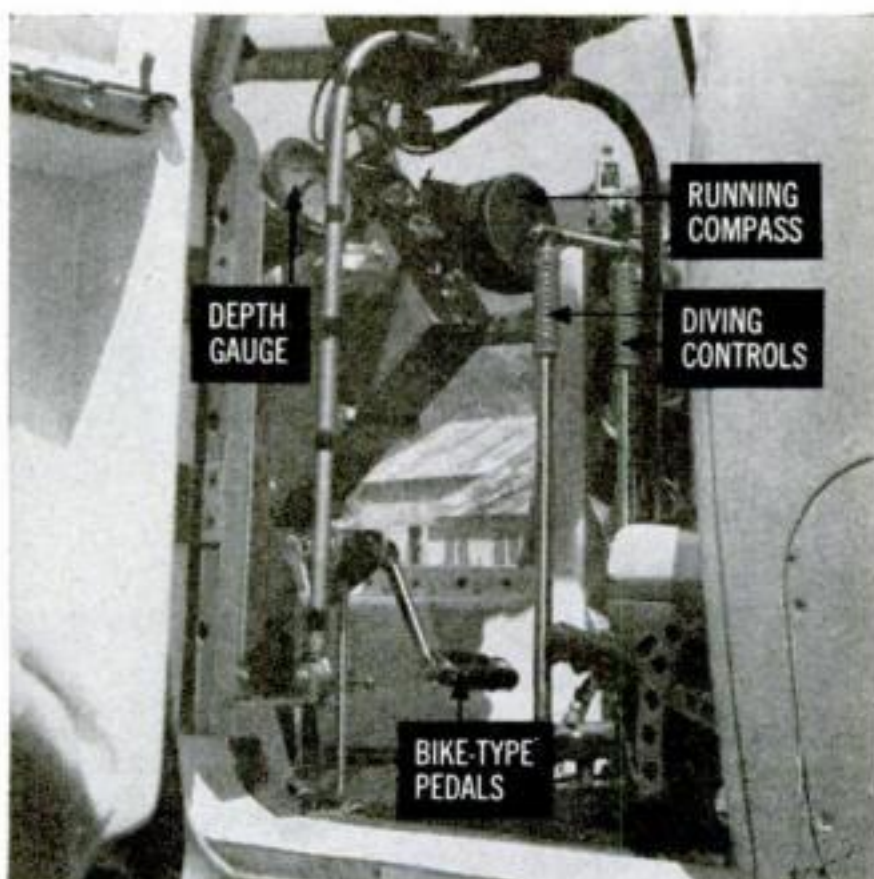
"Can you fire torpedoes?"

"Sorry—no details on armament."

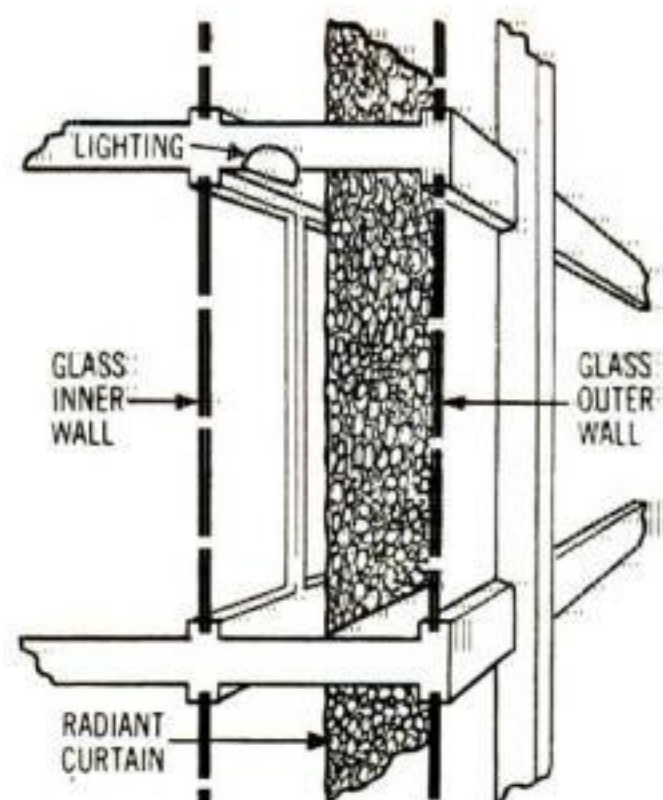
"Those homing torpedoes don't need a tube for firing," I said. "You just drop them in the water near a target and they take off and kill it—right?"

"Are you asking me or telling me?"

I didn't press—but if Frank Moncrief reads this, I'll lay him a little bet of 10 bucks to a dollar that the Aquabat *will* carry homing torpedoes as soon as she joins the fleet in quantity, which she will shortly do. And when that happens, the sky is the limit. A torpedo with a hydrogen warhead, for example, would blow up more than a ship. It would blow up a good-sized seaport. And there isn't any reason in the world why such a weapon couldn't be loosed from a simple clip on the flank of an Aquabat.



FRONT COCKPIT of Aquabat, with pilot out, shows marked resemblance to lightplane's. **END**



AIR-WALL BUILDING. This structure features a new kind of architecture: an air wall between two skins of glass held up by a steel frame. In the space between them will be lighting fixtures and a plastic radiant curtain for heat when needed. Cool air is pumped in during summer. The designer is Prof. A. William Hajjar, who is supervising construction of a 20-by-20-foot prototype on the Pennsylvania State University campus.



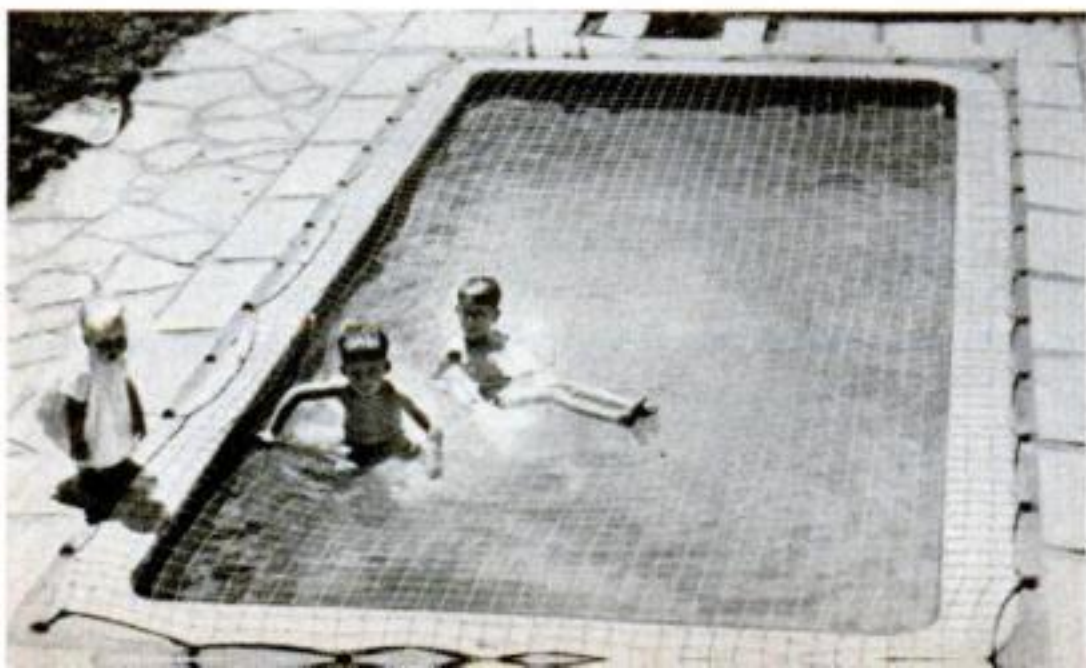
FIRE RITES. Without incantation, chemical engineers at left ignite a measured quantity of boron fuel in a crucible. Next step: trying out extinguishing agents for in-flight and ground control of super-hot flames produced by high-energy "zip" propellants.

Experiments are being conducted by the Midwest Research Institute at Kansas City, Mo., for the Air Force Research and Development Command.

GIANT REACTOR. Too big for shipping by rail, the 300-ton reactor at right was sent by the New York Shipbuilding Corp. from Camden, N.J., down the Atlantic, through the Gulf and up the Mississippi. It is for use by Commonwealth Edison at its nuclear power station being built at Dresden, Ill.



SAFETY RIG. This nylon net covers a private swimming pool in Melbourne, Australia. Stretched across the water and anchored fast at the edge, it is a safety measure for the protection of small children who might tumble in at play.





What Happens When You Get Mad

***To curb your temper or let it fly: that is
the question. Either can be dangerous***

By Theodore Irwin

DURING a ball game in Boston last September, the mighty Ted Williams watched a third strike whiz by him at the plate. Blowing his stack, the terrible-tempered slugger flung his bat into the stands where it bounced off a fan's head and landed her in a hospital.

"I was mad at myself," Williams said later. "I really wanted that base hit."

Anger, whether uncontrolled or bottled up, can be a dangerous emotion. You've heard the familiar phrase, "He was so mad he didn't know what he was doing." Flying off the handle has caused countless highway accidents, injuries on the job, marital bust-ups, and homicides. Repressed anger has brought on psychosomatic asthma attacks, hypertension, migraine, colitis, angina pectoris and a host of other real and



Terrible-tempered Ted Williams flung his bat into the stands, where it hit a fan.

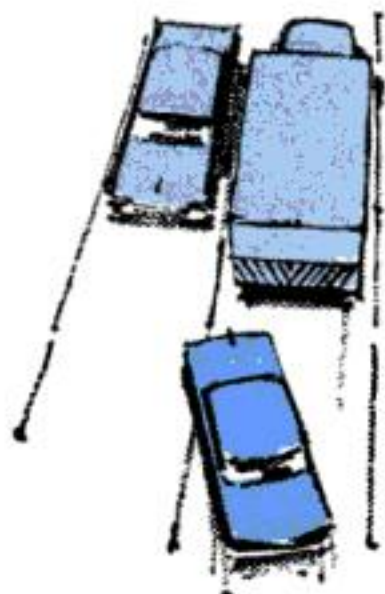
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The male animal loses his temper mostly on weekdays, commonly against objects.



When you lose your temper, your fists clench instinctively and your face reddens.



The angry motorist is the tailgater, the red-light jumper, the passer and weaver.

imaginary illnesses. Studies conducted recently about anger have led to a number of provocative concepts:

- Men lose their tempers mostly on weekdays, commonly against ornery inanimate objects. The female ire is aroused most often on weekends and holidays, commonly by people and social slights.

- You blow your lid most often before meals, when you're hungry and tired. Mild marital spats usually occur before breakfast, violent ones before dinner.

- A bad temper is contagious. If a man is a hot-head, his children probably will be, too—in unconscious imitation or self-defense.

- Between the ages of 10 and 25, your irritability is at its lowest. Then it steadily increases until from 40-60 your rage capacity is highest. After 60, you tame down.

Seeing yourself as others see you

If you were to look into a mirror when you lose your temper, you'd see yourself redden. The veins in your face, neck and temple swell. Instinctively your fists clench and you may be speechless. Your vision may be blurred because the emotion blocks off the visual centers of your brain; such a "blind rage" is at the roots of many a highway tragedy. Your body seems warmer, a fact reflected accurately in slang: You're "burned up" or in a "slow burn" and you have to "cool off." The drastic transformations that anger produces in the body were described by Dr. Walter Cannon of Harvard some 30 years ago:

"Respiration deepens; the heart beats more rapidly; the arterial pressure rises; the blood is shifted away from the stomach and intestines to the heart, central nervous system and the muscles; the processes in the alimentary canal cease; sugar is freed from the reserves in the liver; the spleen contracts and discharges its content of concentrated corpuscles, and adrenin is secreted from the adrenal medulla."

Your temper can be the death of you

The toll of unmanageable anger is incalculable. "Accidents," points out Dr. Walter Woodward, consulting psychiatrist for the American Cyanamid Company, "are very often the result of individuals pouring out their hostility on their environment."

Emotional causes of accidents are often deeply hidden in the private lives of workers. Bottled-up wrath may cause poor coordination, slow reaction time, inability to size up a situation in time to avoid getting hurt.

On our highways, psychiatrists have observed, anger kills more motorists than blowouts. Dr. Herbert J. Stack, of the New York University Center for Safety, declares that "one of the underlying causes of accidents is faulty attitudes—shown, for example, in anger resulting from frustration."

The angry motorist is the tailgater, the red-light jumper, the erratic passer and weaver. Innumerable highway accidents are actually caused in the home. Says Dr. Clara Thompson, of the William Alanson White Institute of Psychiatry:

"When a man drives a car after his wife has given him a

bad time and he has swallowed his resentment instead of talking back, the chances are good that he will, unconsciously trying to work off his hostility, get into an accident."

Increasingly, trucking and bus firms are trying to weed out the hot-tempered. Candidate drivers for the Greyhound Bus Lines are deliberately needled in psychological tests or by instructors at the training school. Those who blow their tops are dropped.

Can "swallowed anger" poison you?

That hidden anger creates or contributes to physical ailments has been demonstrated through impressive studies at New York Hospital-Cornell Medical College by Drs. Stewart Wolf, Harold G. Wolff and others. Many cases of nose ailments, colds and sinusitis coincided with major emotional upheavals. In one patient, anger became a stabbing pain in the back; in another, it produced a splitting headache. "Swallowed anger" often triggered indigestion; many patients with high blood pressure were bottling up their rage. Victims rarely linked their feelings with their illness.

Symptoms of some patients could be turned on and off by the Cornell researchers simply by mentioning the target of anger. With one patient, a mere reference to his wife brought on an asthmatic attack.

Confirmation of the psychosomatic impact of anger has come from a number of other investigators. "Anger," says Dr. N. C. Gilbert of Northwestern University, "frequently brings on attacks of angina pectoris. It causes more pains and attacks than any other one emotional disturbance."

Dr. Alan A. McLean, psychiatric consultant for IBM, points out that "since society frowns on loss of control over our feelings, we subconsciously channel our anger into physical symptoms—an illness is more socially acceptable."

Infuriating the "guinea pigs"

Until recently, surprisingly few scientists had explored the labyrinths of this complex emotion. Dr. Walter Cannon's pioneering work led him to theorize that the physiological reactions he described aroused a person to maximum effort for either fight or flight. He taught that the anger and fear of the fight-flight reaction were inseparable, always associated with secretion of adrenalin. But he couldn't explain all his findings. Then, a few years ago, Dr. Alfred F. Ax of Harvard devised two laboratory situations, one to anger his subjects, the other to frighten them. He discovered that, contrary to Cannon's theory, anger and fear produced separate sets of physiological reactions.

Important recent strides toward the understanding of anger have been made in the latest investigation, by Dr. Daniel Funkenstein of Harvard Medical School, who is clinical director of psychiatry at the Massachusetts Mental Health Center in Boston. In a two-year project partly supported by the U. S. Air Force School of Aviation Medicine, Dr. Funkenstein and his aides studied the stress reactions of 125 healthy Harvard undergraduates.

First, the students were told they'd be given simple



Hidden anger may trigger stabbing pain in the back, splitting headache, high blood pressure, asthma, indigestion, colds, colitis or sinusitis.



Anger is a complex reaction, unlike fear, producing different physiological changes.

eighth-grade arithmetic problems they could solve without pencil and paper. But the problems weren't easy, and the experimenters taunted and harassed them. Then the college men were subjected to a "sonic confuser." Each was asked to read a story and then repeat it very fast from memory. Through earphones, the student was allowed to hear himself—but in a delayed feedback. If he slowed down, he received a mild electric shock, reminding him to speed up. The faster he tried to speak, the more the sonic confuser made him stammer, which in turn prevented him from talking rapidly. Frustration and rage were inevitable. After the tests, one student reported, "I had a terrible headache after I left here." Another: "I was angry for three days."

Anger-in or anger-out?

Dr. Funkenstein defined the three most common emotional reactions in his tests as Anger-In (directed toward the self), Anger-Out (directed outward toward someone else), and Severe-Anxiety. He also discovered that, as the nervous system reacted differently to anger than to fear or anxiety, specific chemical substances in the body distinguished one emotion from another.

Physiologically, the Anger-Out person had too much nor-epinephrine (suspected of being secreted in sympathetic nerve endings). Anger-In and Severe-Anxiety persons stored too much epinephrine, a metabolic secretion of the adrenal medulla that incites widespread mechanisms throughout the body. In contrast, nor-epinephrine produces almost no generalized response.

The Anger-In group had a much faster pulse rate than the others. Some of this group, surprised to be so "ill-treated," felt depressed, wept openly, berated themselves. The Anger-Out men showed a low intensity of physiological response, but outwardly were wrought up. Typically, one senior who aimed his hostility away from himself grew red in the face when the experimenter asked if he was angry. Pounding a table with his fist, he exploded: "I'm *not* angry. I'm just sore and irritated. I have never been angry in my life." Leaving the room, he slammed the door.

Expressing "anger-outward," Dr. Funkenstein explains, is unacceptable in adult polite society. The Anger-Out reaction occurs early in life; as a child grows older he feels the need to curb his temper. Thus the Anger-Out response is more primitive, less civilized, than anger directed against one's self.

How personality affects anger

Interestingly, a battery of psychological tests revealed that if you're an Anger-In man, you're apt to have a close, affectionate relationship with your father, have liberal views, be introspective, blame yourself rather than others, and be aware of emotional factors in your actions. On the other hand, the Anger-Out man often has a strained or hostile attitude toward his father, whom he may describe as stern or difficult. The Anger-Out is inclined to have conservative views, to harbor prejudices, blame others and show little

[Continued on page 214]



Pounding the table, he exploded: "I'm just sore. I've never been angry in my life."



PENALTY BOX

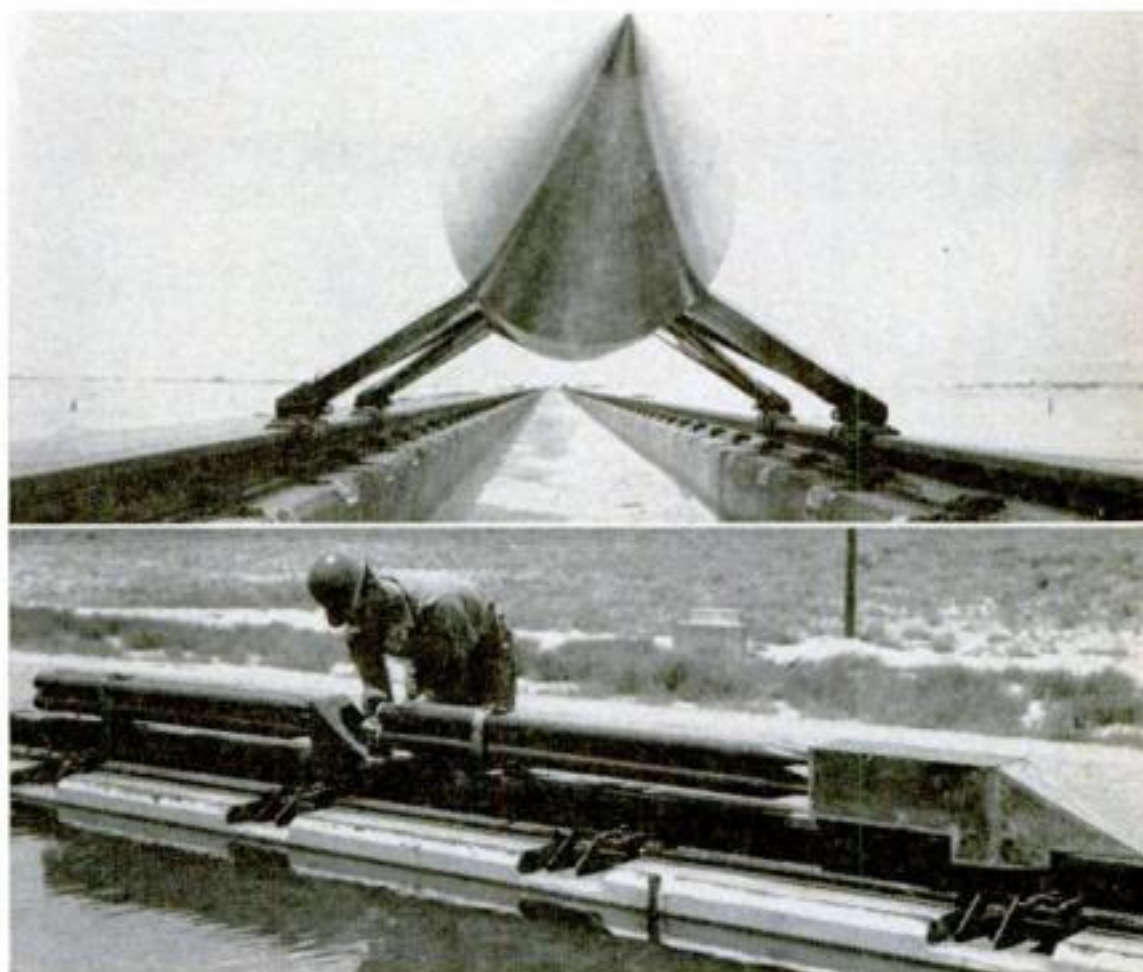
Scientists, using lab tests, could predict which players were apt to get into fights.

FLYING TV. The Bell Ranger at right, first helicopter TV station, has a special antenna below its fuselage. It can transmit parades, spectacles, forest fires and the like.

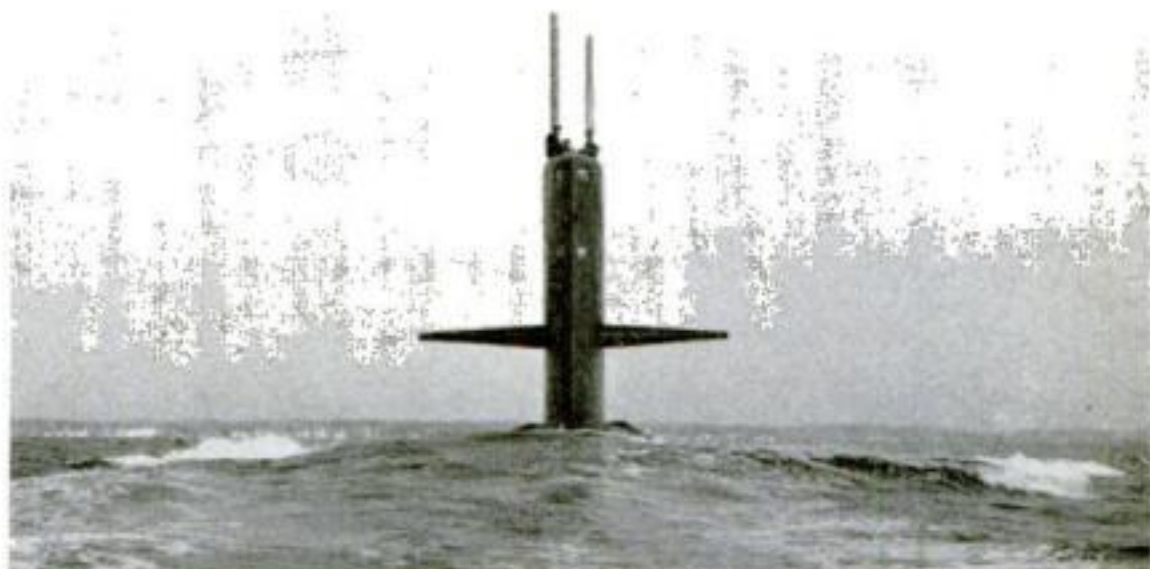


CYCLOPS. No one-eyed monster this, but a technician standing behind a Picker X-Ray radioisotope machine and positioning it with chains. He'll leave the blockhouse before turning on its cobalt 60 gamma rays to X-ray metal samples.

SKIPJACK. Showing only her diving planes and sail (formerly conning tower), the nuclear-powered submarine Skipjack (right) heads for open sea. On her maiden voyage she broke all submarine speed records.

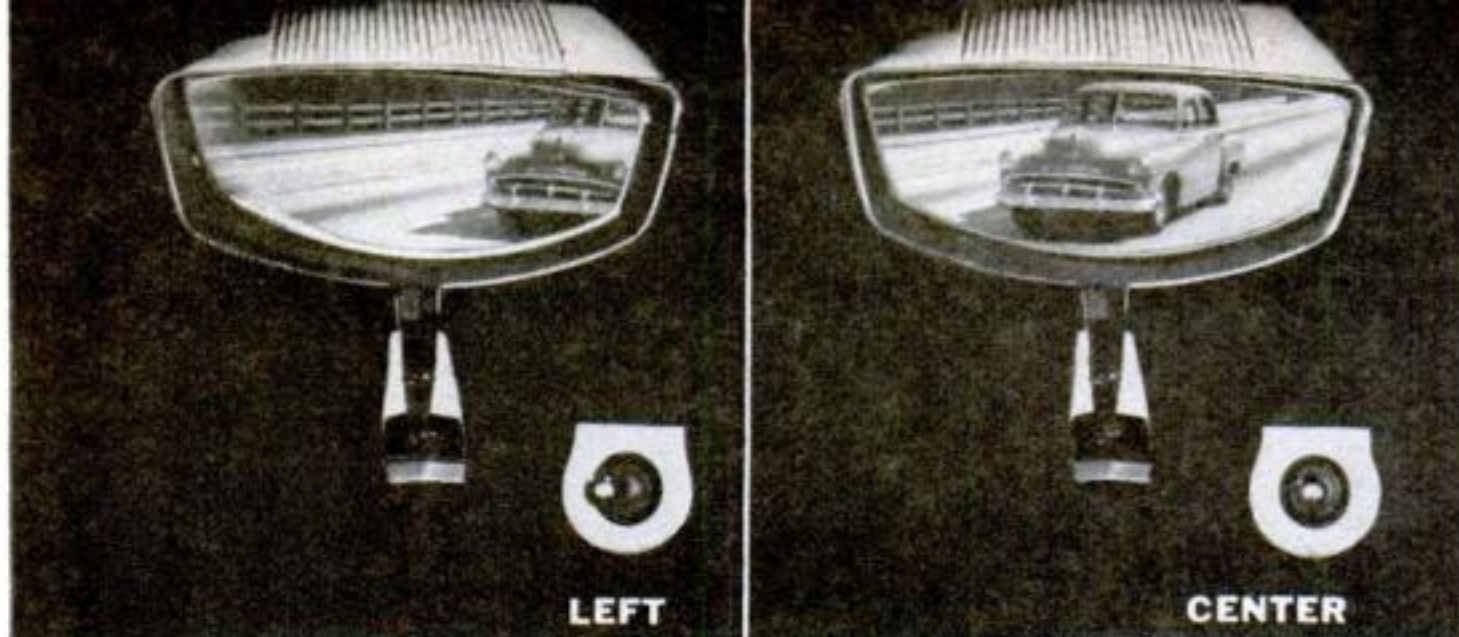


FASTEST ROCKET SLEDS. These captive missiles travel at four times the speed of sound on the new 35,000-foot test track at Holloman Air Force Base, N. Mex. The sled at top carries a load of 200 pounds, the monorail below has a pusher behind its payload.



COPPER DOMED. A striking copper shell 150 feet in diameter and resting on arches covers the roof of the new Academy of Science Building at Canberra, Australia. The air-conditioned building has a conference room for 200.

WHAT'S NEW



LEFT

CENTER

Outside Car Mirror Adjusts from Inside

You don't have to get out of your car to adjust this new remote-controlled side mirror. At the flick of a lever on your dash, you can continually vary the angle of rear view to suit different drivers or changing road conditions, as seen in the

photos above. How the control works is shown in the drawing at right. The mirror, recessed in a streamlined housing, is better shielded against snow and rain than open types. Price is \$13.50 from Roberk Co., Norwalk, Conn.



FENDER SAVER.

These 30" rubber strips nailed to the sides of your garage door protect your car's fenders if they begin to nudge a narrow opening. They're \$5.95 a pair from Johnson Products, 9972 Springfield Pike, Cincinnati, Ohio.

FLIPS ITS LID.

This sleek fiberglass "hardtop" swings back on swivels so you can get in and out of speedboats easily. The underside is black-speckled to cut sun glare. The top comes in four sizes to fit hulls from 14' to 20' long. Prices are about \$120 to \$198 from Seabreez Marine Products, Sugar Creek, Mo.





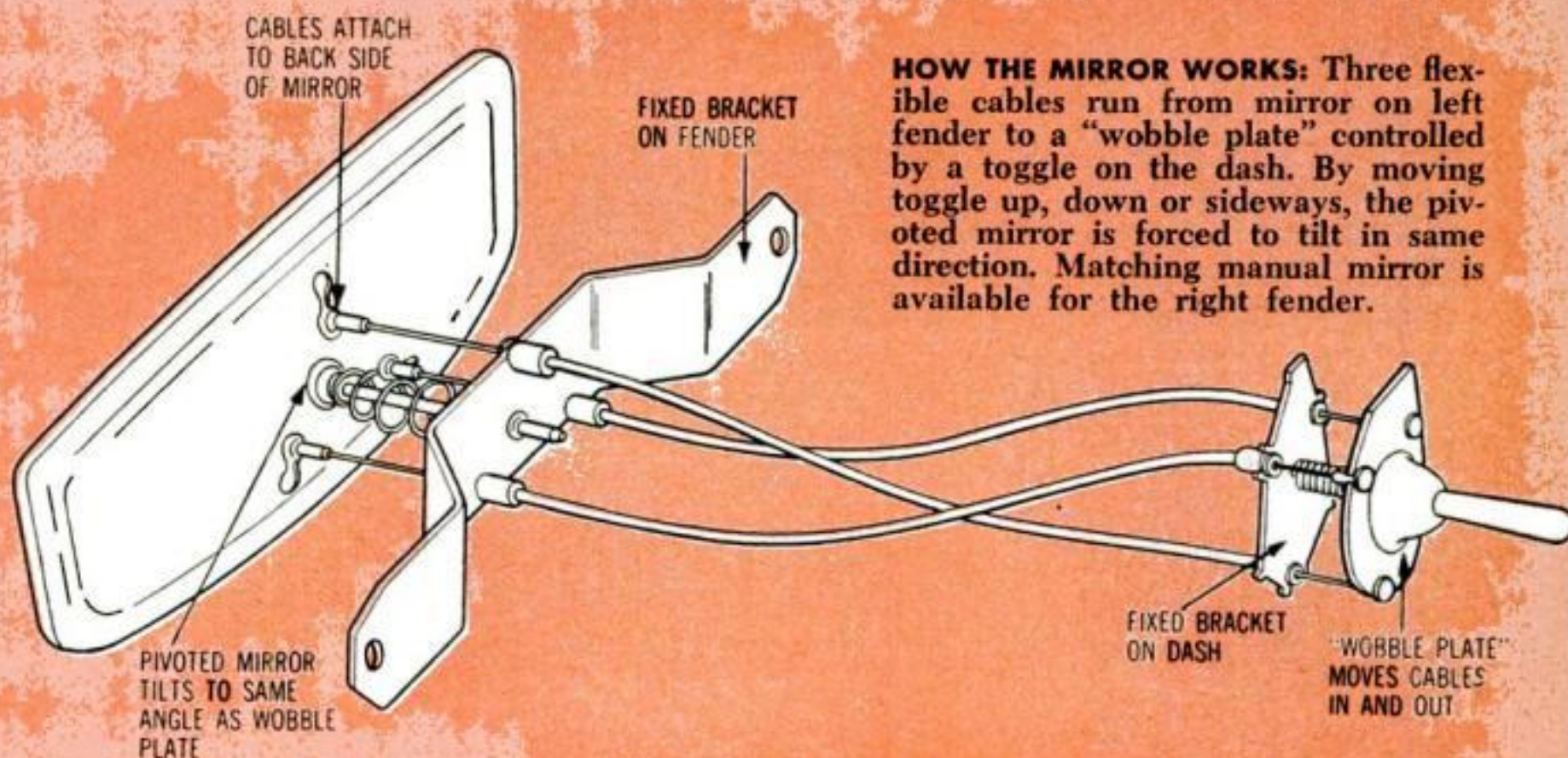
RIGHT



UP



DOWN



HOW THE MIRROR WORKS: Three flexible cables run from mirror on left fender to a "wobble plate" controlled by a toggle on the dash. By moving toggle up, down or sideways, the pivoted mirror is forced to tilt in same direction. Matching manual mirror is available for the right fender.

MAP PLOTS ANTENNA. A moving beam of light behind this translucent world map shows where a power-rotated antenna is pointing for best reception. It comes centered in east, west or central U. S., depending on where you live. Hy-Gain Antenna Products, Lincoln, Neb.

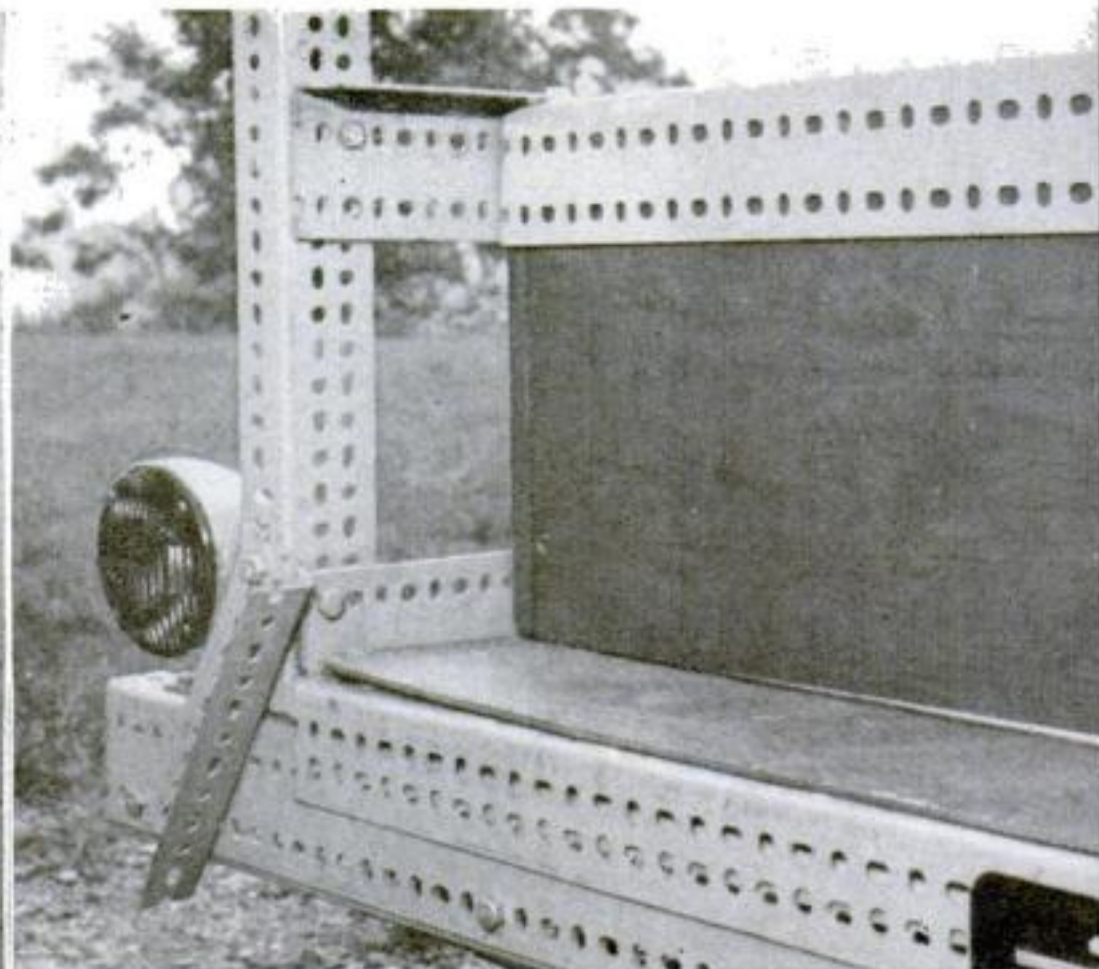


What Would You Be Doing?

CAN YOU GUESS what special job you'd be doing with this odd-looking hammer recently announced by the Estwing Mfg. Co.? For details about this new tool, please turn the page.



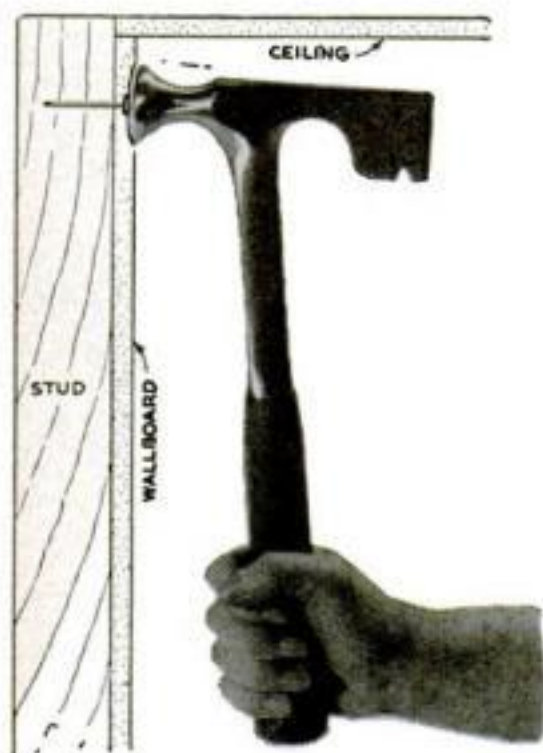
WHAT'S NEW



Metal "Lumber" Makes Anything

These new steel angles can be put together and taken apart over and over again like a giant toy Erector set. With them, you can build all sorts of structures such as the trailer above, camp shelters, racks and play equipment. Sold in 10'

and 12' lengths, they have alternating slots that insure matching bolt holes no matter how you put them together. A cutter snips off pieces without your having to hacksaw them. Republic Steel, Berger Div., Canton, Ohio.



WHAT'S GOING ON HERE? You'd be putting up plasterboard if you used this new all-steel dry-wall hammer. Its back-tilted head nails safely in corners without marring adjacent surfaces. The rounded head "dimples" the board, and a blade scores panels for cutting. Price: \$6.50, Estwing Mfg. Co., Rockford, Ill.

POCKET DRIVER.

Ten attachments fit this small, versatile driving tool. The ratchet-action handle takes two screwdriver blades—regular and Phillips—three square sockets and five hex sockets. An adapter lets you work at right angles in tight spots or for more leverage. Price is \$3.65 from R. S. Rubin, 1315 W. 76th St., Kansas City, Mo.



DUAL WRENCH.

New adjustable wrenches convert quickly to spanner wrenches by inserting extension rods in the jaws. An 8" model adjusts from 1/4" to 1 1/8" I.D., a 12" size from 7/8" to 2 1/4" I. D. Additional offset extension rods span up to 3 1/2". Hydraulic Jack Packing & Tool Co., P. O. Box 50, Bloomfield, N. J., makes the wrenches.





SCOPE SEES UNDER WATER.

Drop something overboard? This tubular aluminum scope is said to "see" as far as 30' down for spotting lost tackle, dangerous reefs or good fishing grounds. It comes in three lengths—2', 4' and 6'—for about \$10 to \$17 from West Point Fishscope Co., West Point, Neb.



KIT BUILDS PHONOGRAPH.

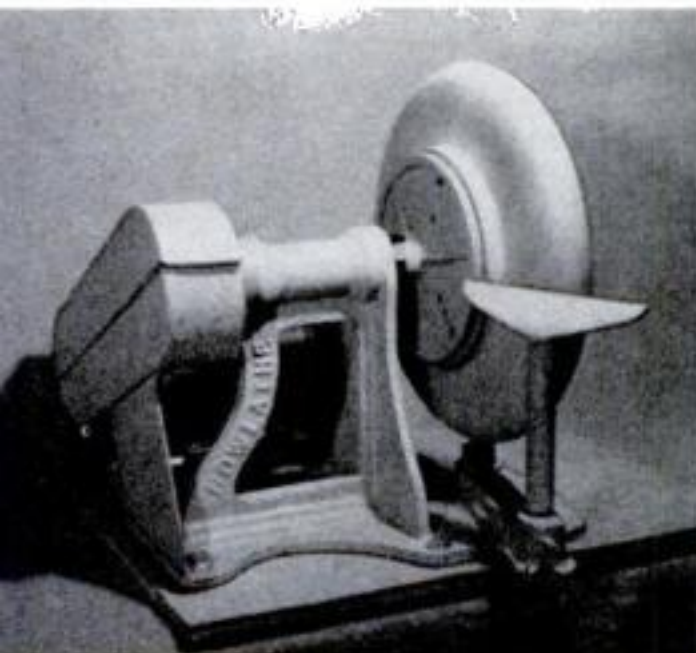
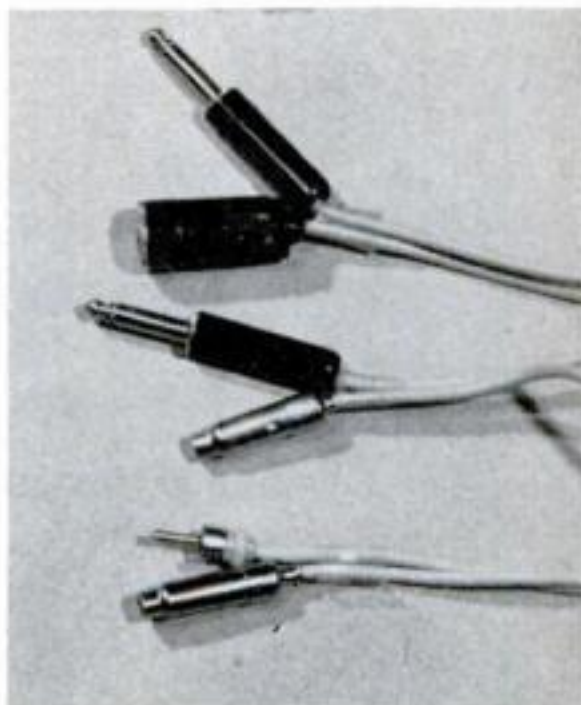
Now in kit form, this portable three-speed phono and radio comes with printed circuits and plug-in parts for easy do-it-yourself assembly. It plays 100 hours on four flashlight cells, costs about \$75. Kits without radio are also available. Tri-Phi, Inc., Albertson, N. Y.

SHORTY LATHE.

You can turn giant bowls and other diameters up to 16" on this faceplate lathe without the cost and space limitations of full-size lathes. Clearance behind the faceplate and a swiveling tool rest permit both sides to be worked without removing and reversing the turning. Bowlathe Co., 123 Bruce Rd., Walpole, Mass.

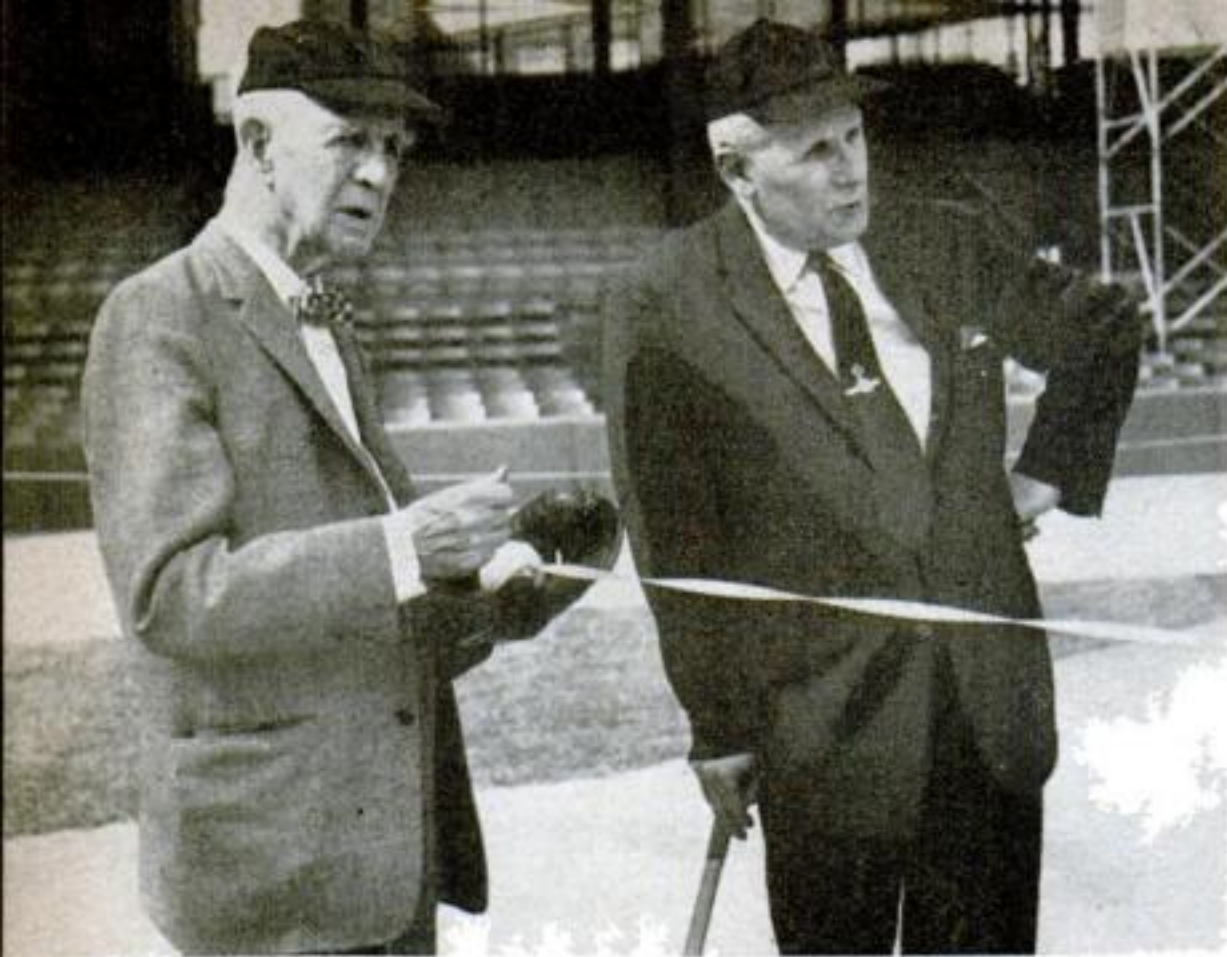
QUICK—A BULB.

Up to 12 spare lightbulbs and fuses can be stored on this wall rack so you'll always have one handy when you need it. They screw into dummy sockets in the plastic holder. The "Stor-A-Bulb" racks come in red, yellow and mottled gray from Galpo Products Co., 17597 James Couzens St., Detroit.



HI-FI HOOKUPS.

You can quickly join players, pre-amps and amplifiers with prewired connectors that save soldering your own. They come 3' to 6' long in various combinations of phone and phono plugs and jacks to mate nonmatching parts. Lafayette Radio, 165-08 Liberty Ave., Jamaica, N. Y.



TO COUNT THE TURNS of a pitched baseball in motion, Dr. Lyman Briggs attached a strip of tape to the ball. Ossie Bluege, former third baseman and manager of the Washington Senators, supplied an expert's kibitzing.

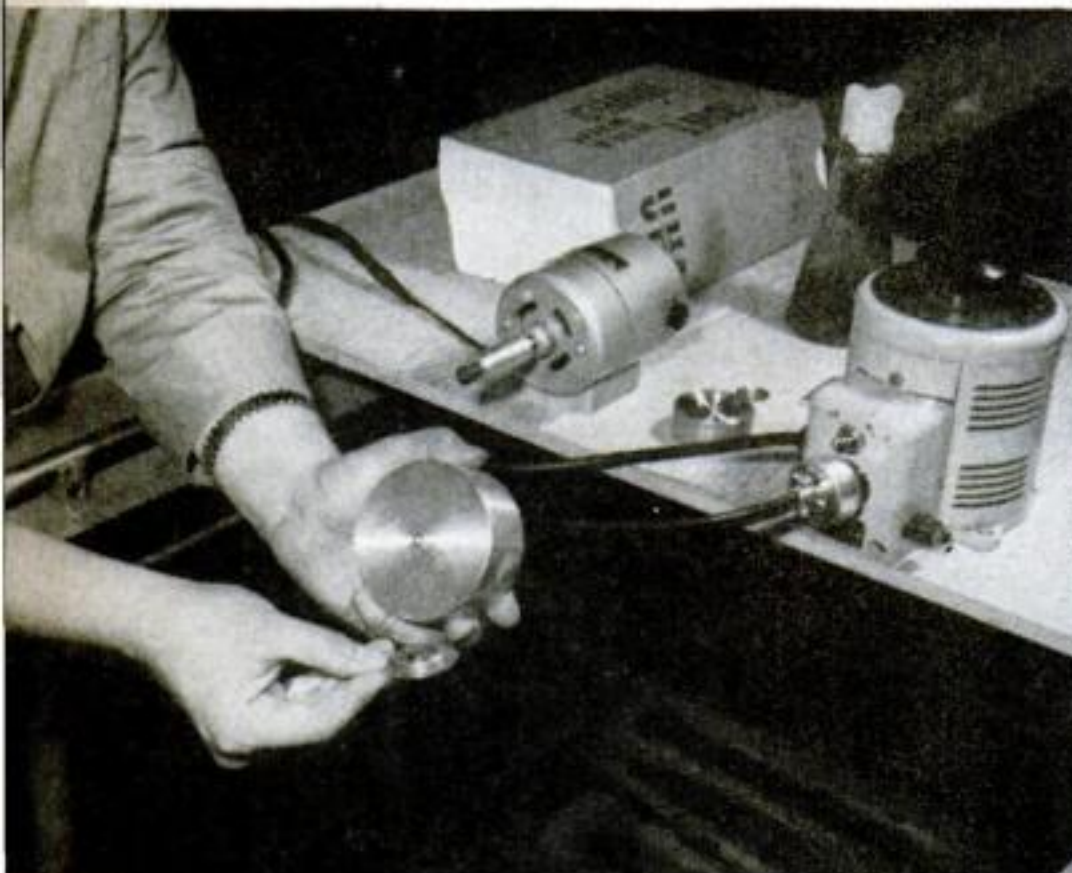


FAST BALL →
11.7 IN. @ 1,200 R.P.M.
17.5 IN. @ 1,800 R.P.M.

ROUND AND ROUND spins pitched ball, stirring up a whirlpool of air that interacts with oncoming wind to make ball swerve. The faster the spin, the wider the curve, up to 17½ inches. Curves here are traveling 100 ft./sec.

What Makes a Baseball Curve

Cylinder spinning in water acts like a ball in air



IMITATION BASEBALL is an aluminum cylinder with a small ball bearing to make it spin easily. A small motor (on table, at left) with a rubber-tipped shaft makes the cylinder spin around.



IMITATION BALL DIAMOND is a laboratory water table. Cylinder is placed under water by researcher at Stevens Institute. Light from below makes shadow patterns on tracing paper.

**Cannonball, rocket, baseball
behave alike: If they spin, they
curve in flight. Here's why**

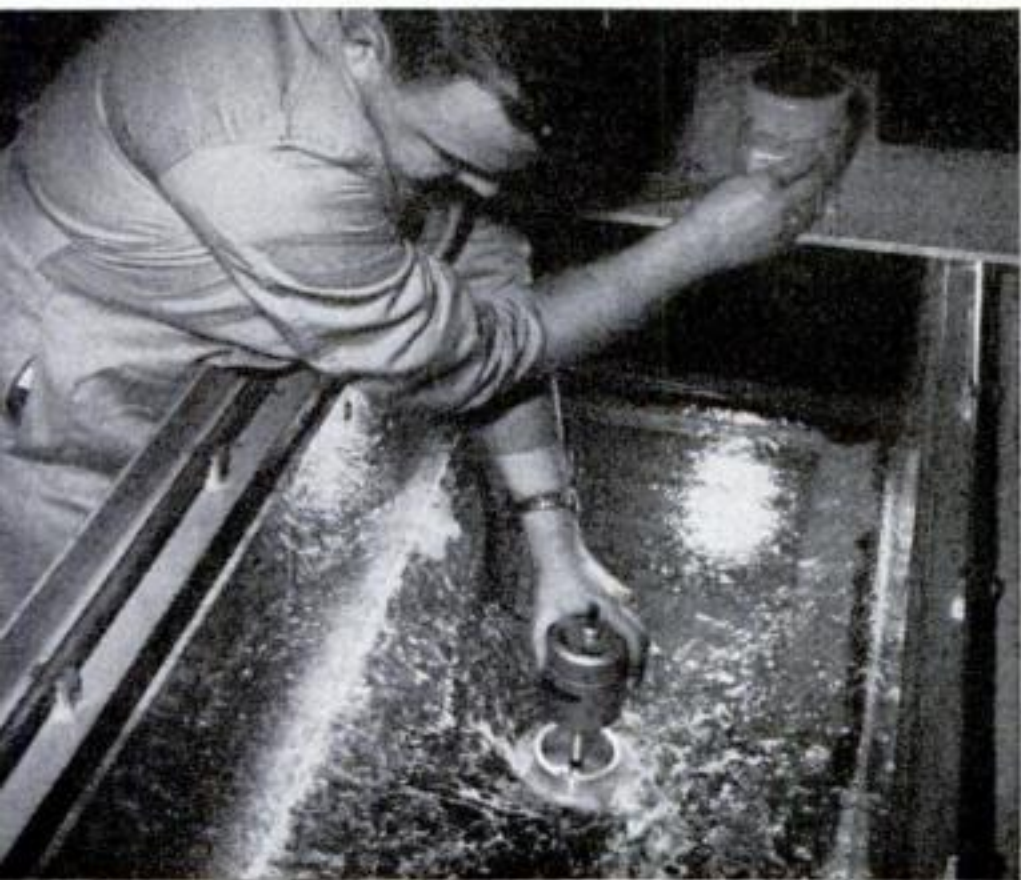
BASEBALL, oddly enough, has gotten mixed up with missiles. One by-product of research on the ultra-modern weapons: figures showing just how much a pitcher can make his fast ball curve.

Missiles—antique cannonballs as well as modern rockets—also curve in flight in air if they spin, just like baseballs. And for the same reason.

An elderly but spry baseball fan, Lyman J. Briggs (better known as physicist, long-time head of the National Bureau of Standards, and present director of research for the National Geographic Society) used the NBS wind tunnel after-hours to measure baseball curves.

He found: The best a good pitcher can throw is about $17\frac{1}{2}$ inches of curve in the 60 feet from the mound to the plate. That's for a ball going 100 feet per second and spinning at 1,800 r.p.m.

To show why the ball curves, POPULAR SCIENCE shot the photos on this page at Stevens Institute of Technology, Hoboken, N. J. Ed Rakowski of the Stevens staff set it up, using a metal model for a baseball and a stream of running water to represent the air flowing past a thrown ball. The ripples in the water, which show

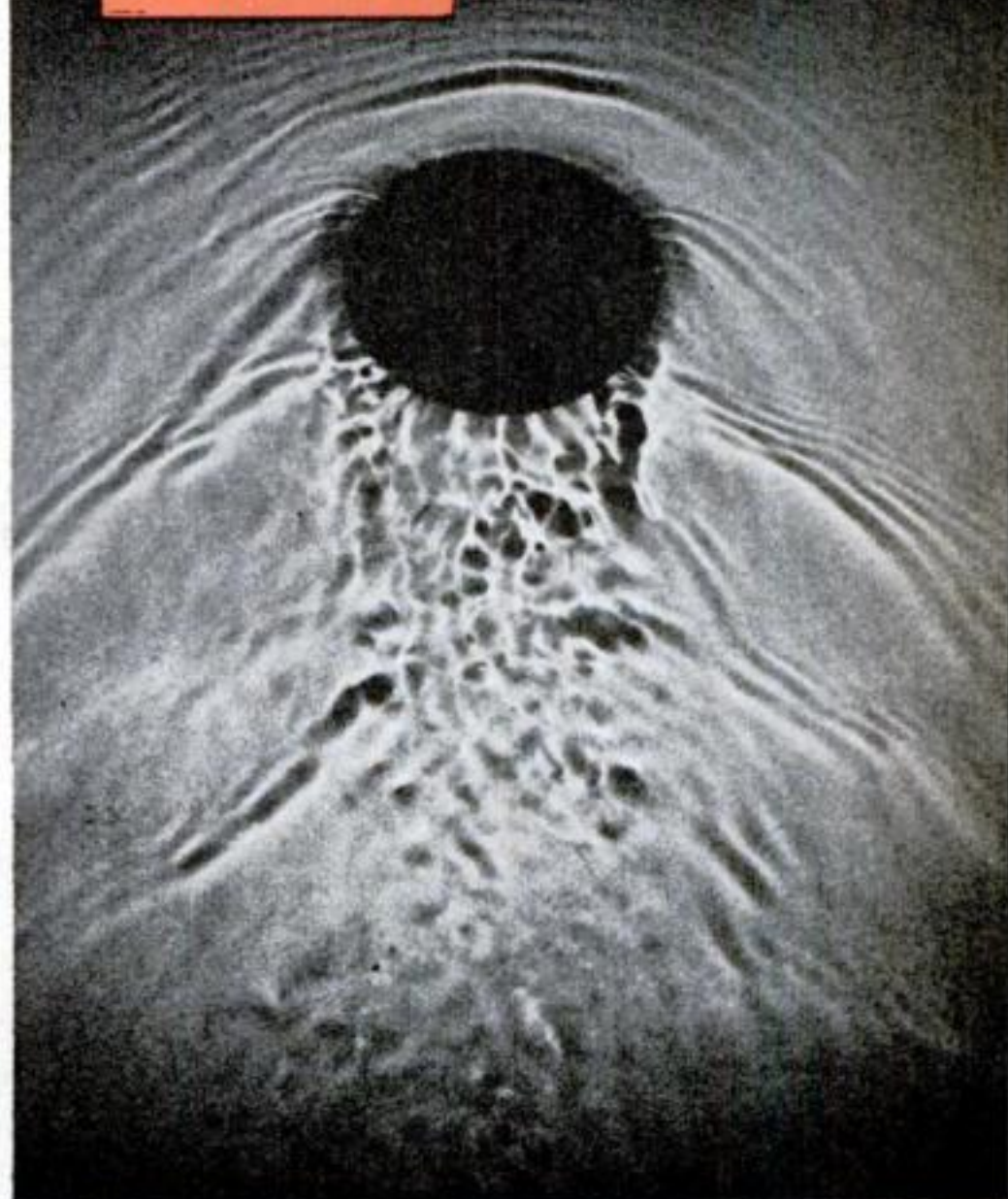


IMITATION PITCH: Water flowing over the table is agitated by the spinning cylinder just as the spinning ball agitates the air. Shadow patterns will show exactly what happened.

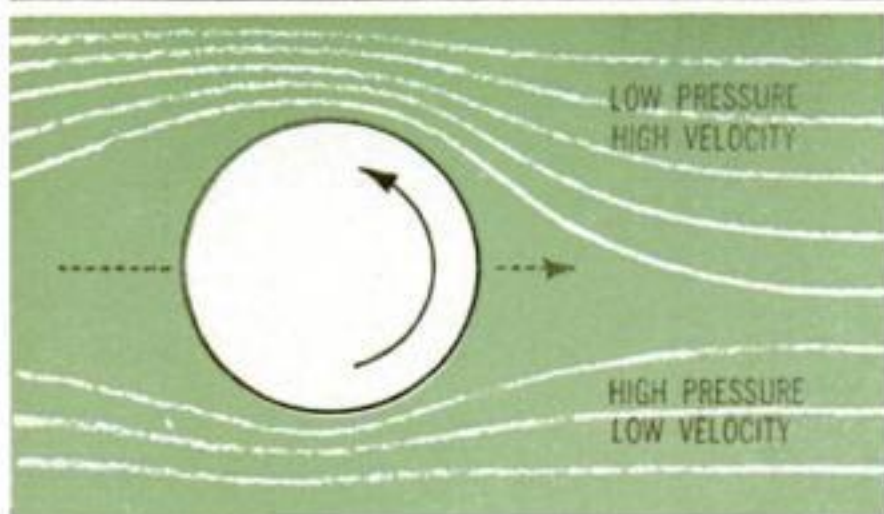
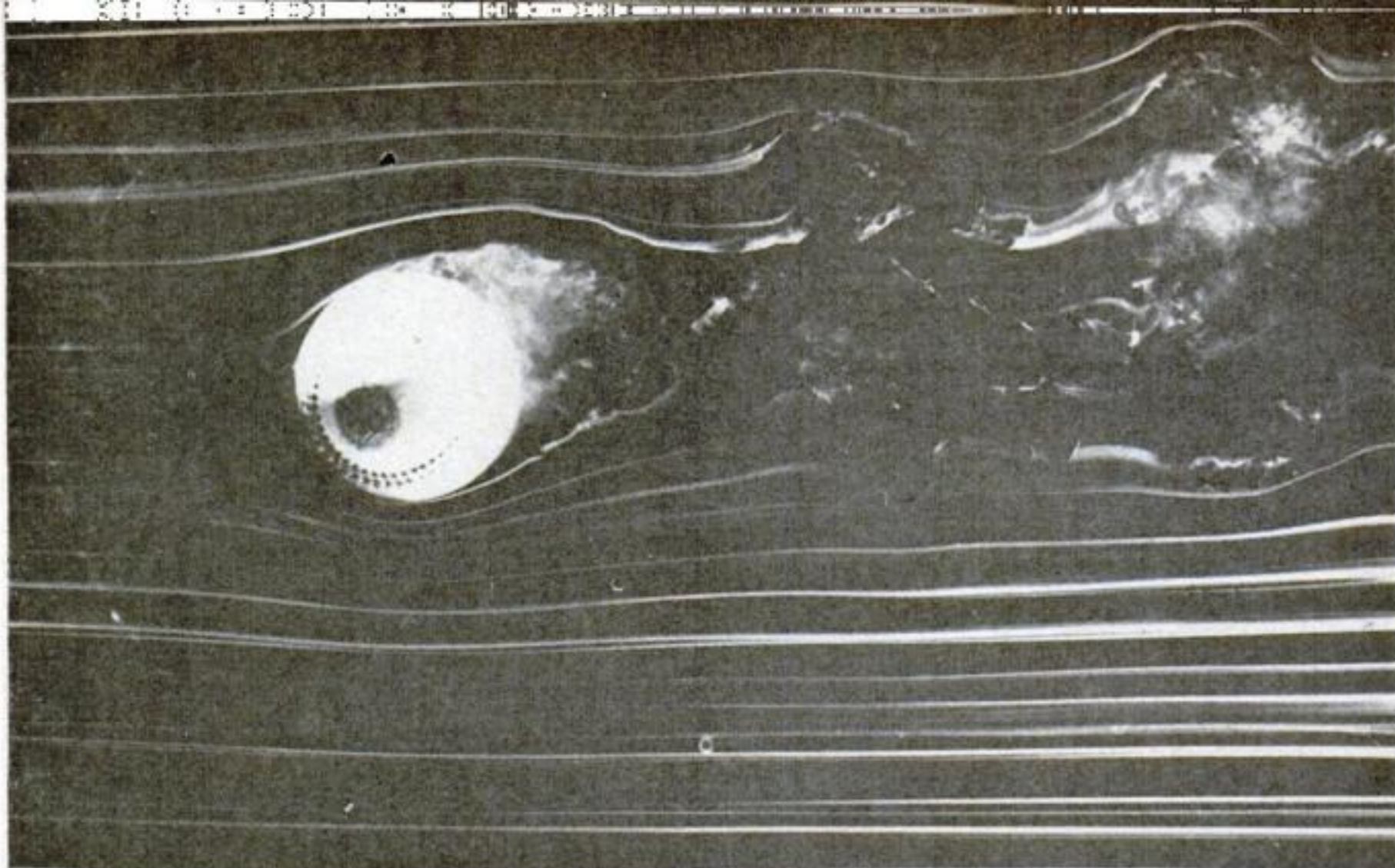
CURVE BALL



STRAIGHT BALL



HERE'S WHAT HAPPENS: Ripple pattern shows water flow (downward) around cylinder. When "ball" spins (clockwise), at top, water piles up at left, pushing cylinder toward right.



IN A WIND TUNNEL, a regulation baseball acts like the imitation in the water table (previous page). Prof. F. N. M. Brown, University of Notre Dame, took this picture of a curve ball through a side window. The wind is from the right, 60 feet per second, carrying white streamers; ball is spinning counterclockwise at 1,000 r.p.m. Crowding of smoke-like filaments above it shows region of higher velocity and hence lower pressure. Higher pressure below tends to push the ball up into a curve and off the straight course. The drawing at left diagrams the play of forces that lowers batting averages.

up clearly when photographed from above, reveal why fluid flowing around a spinning object creates a sideways push.

The spin is what does it.

When a ball spins, it drags air around with it, creating a small whirlpool. If the ball is also moving forward through the air, the whirlpool goes along. On one side of the ball, the whirlpool helps push air past the forward-moving ball. On the other side, it opposes the air motion. So air moves slower past one side of the ball.

Slower flow means higher pressure—the air sort of piles up in a slow-flow region and stretches out in a fast-flow region. This higher air pressure—on the side of the ball where the spin works against forward motion—pushes the ball. It curves (right or left if the spin is horizontal, up or down if vertical).

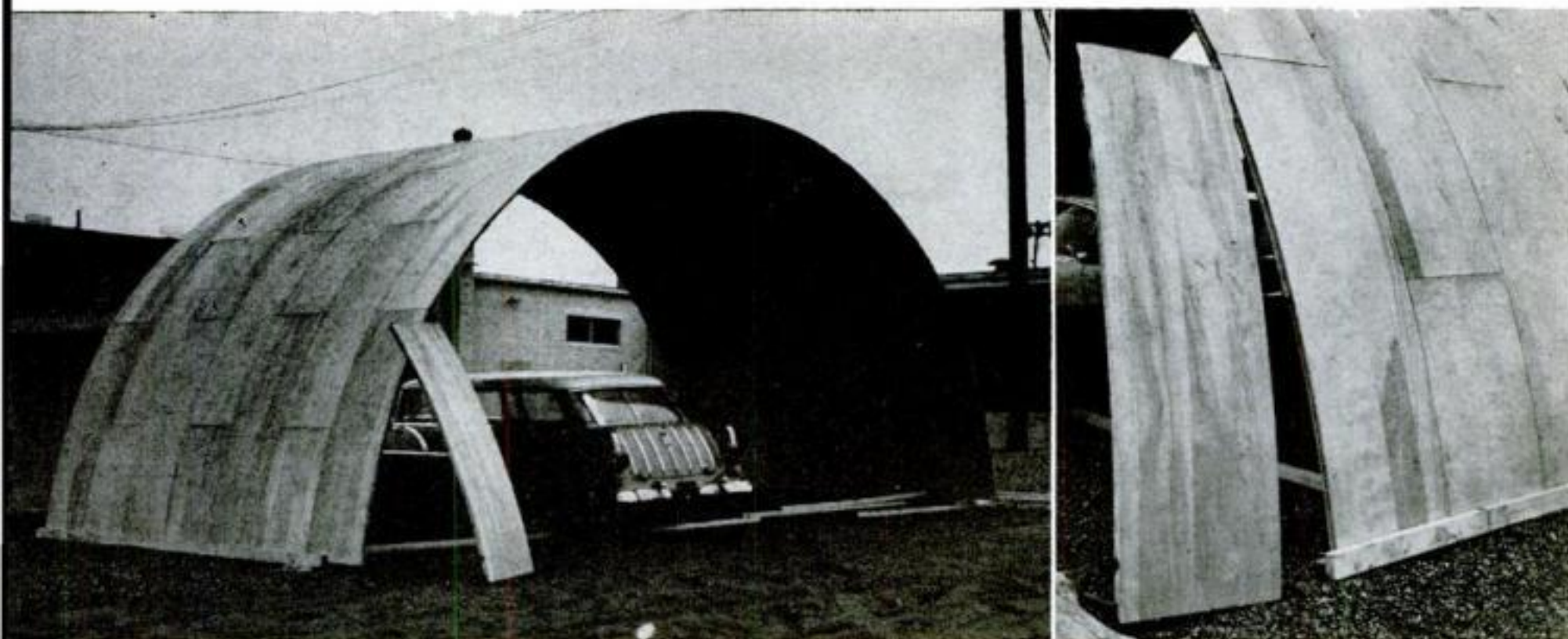
Dr. Briggs made his measurements by dropping a spinning ball into a wind tunnel across the windstream, and measuring the sideways shift between the dropping point and the impact point on the bottom of the tunnel. The impact point was

marked by lampblack smeared on the ball.

A series of tests with different rates of spin and different wind speeds showed that the curve depends mostly on the rate of spin and only a little on how fast the ball was traveling. At 75 feet per second and 1,200 r.p.m., the curve was 10.8 inches (in 60 feet distance); at 150 feet per second and the same spin, the curve was 11.6 inches. But if the speed was held at 75 feet per second while the spin increased from 1,200 r.p.m. to 1,800 r.p.m., the curve jumped from 10.8 to 16.7 inches.

The rates that Dr. Briggs checked are the ones that professional pitchers commonly use. The speed of pitches has been clocked several times (the record: about 144 feet per second—98.6 miles an hour—by Bob Feller of the Cleveland Indians in 1947).

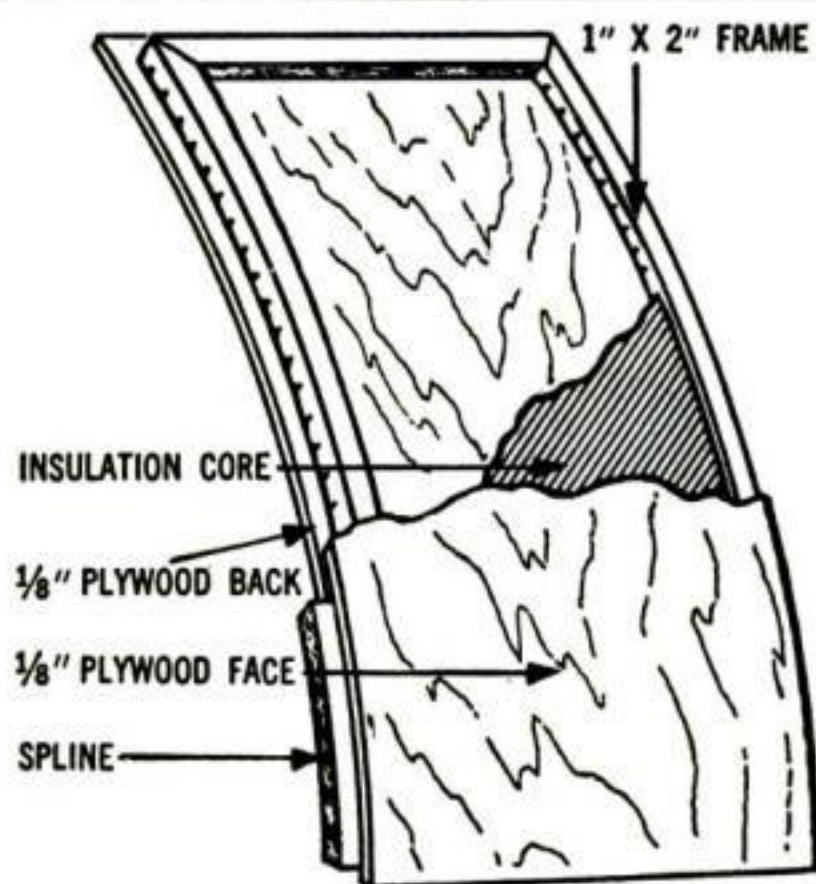
Dr. Briggs measured spin himself on balls thrown by the pitching staff of the Washington Senators. He glued a flat tape to the ball before it was pitched and counted the twists.—*Martin Mann.*



PLYWOOD "QUONSET." Here is a structural-arch building made entirely of curved, stressed plywood panels that provide their own support. Each panel is prefabricated, precurved and prefinished, ready for installation.

The units resemble panel doors, with standard sheets of plywood sandwiching a honeycomb soundproof insulation core on a light frame. Saw kerfs in the frame permit assembly in a permanent curve. Edge grooves are fitted with splines.

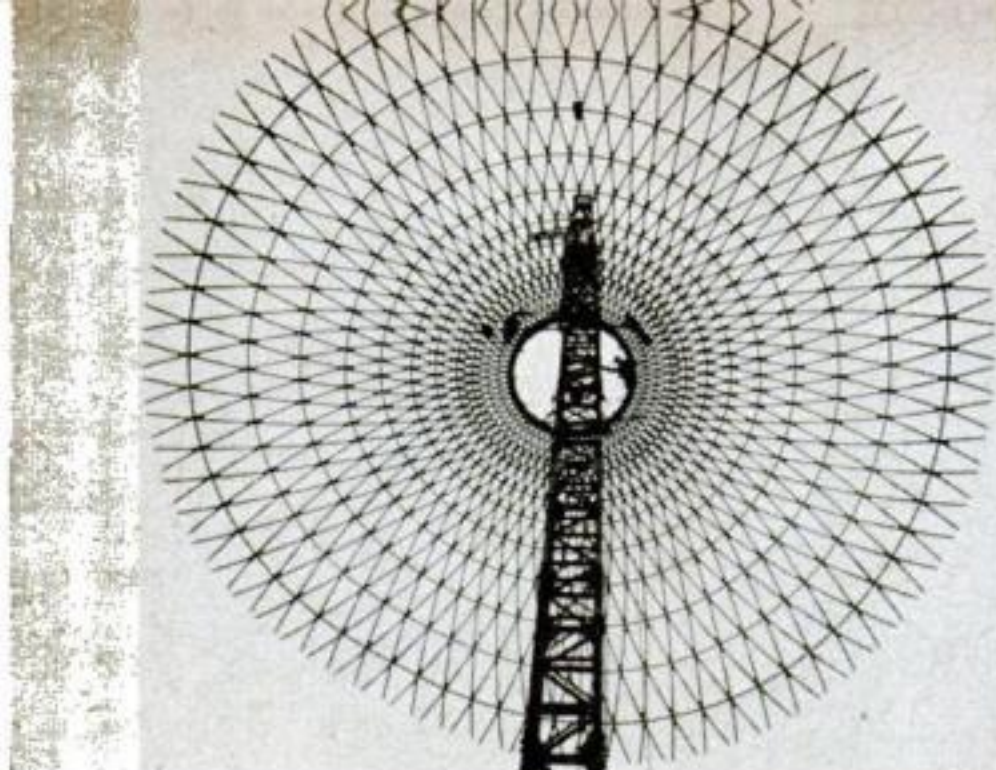
The inventor is William R. Hanst of Cresskill, N.J. He advocates assembly, edge up, on the ground, like a semi-circular fence. Then the structure would be raised upright and additional units attached from a ladder.



TRAILER TENT. The low-slung Dutch trailer above flips its lid at a camp site and unfolds a canopy to provide sheltered sleeping space for six people. A rack on top is for luggage.

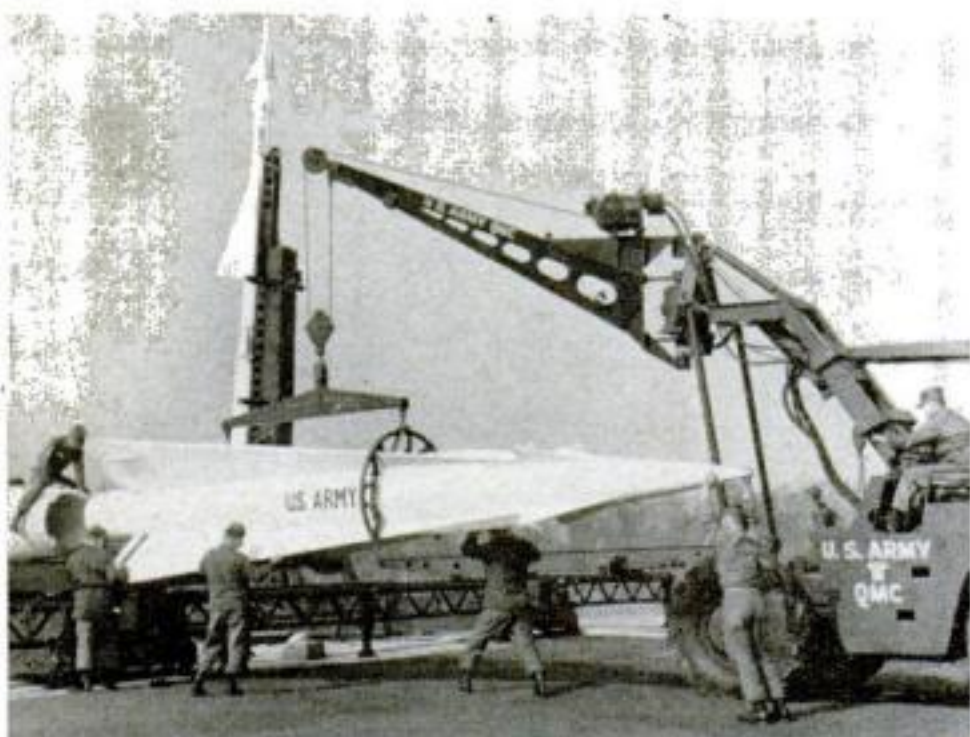


MUSHROOM TOWER. This odd-looking tank near Helsinki stores water in its funnel-shaped top. It rises 114 feet, has a diameter of 137 feet, is one of the largest structures in Finland.



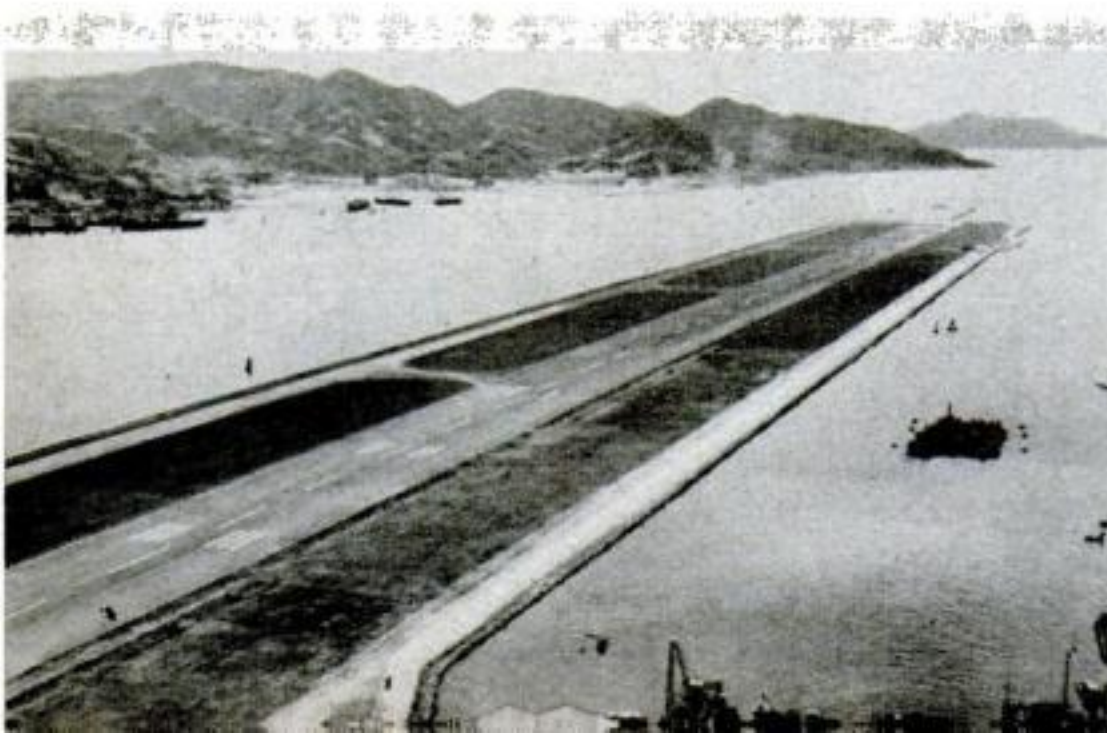
TOPSY-TURVY. Workmen at Brno, Czechoslovakia, seem to be going about it backwards as they start at the top here in erecting a steel-tubing framework for the roof of a big circular pavilion. Sides go up later.

The building's 193,700 square feet of floor space will house exhibits at an international trade fair to be held there in September.

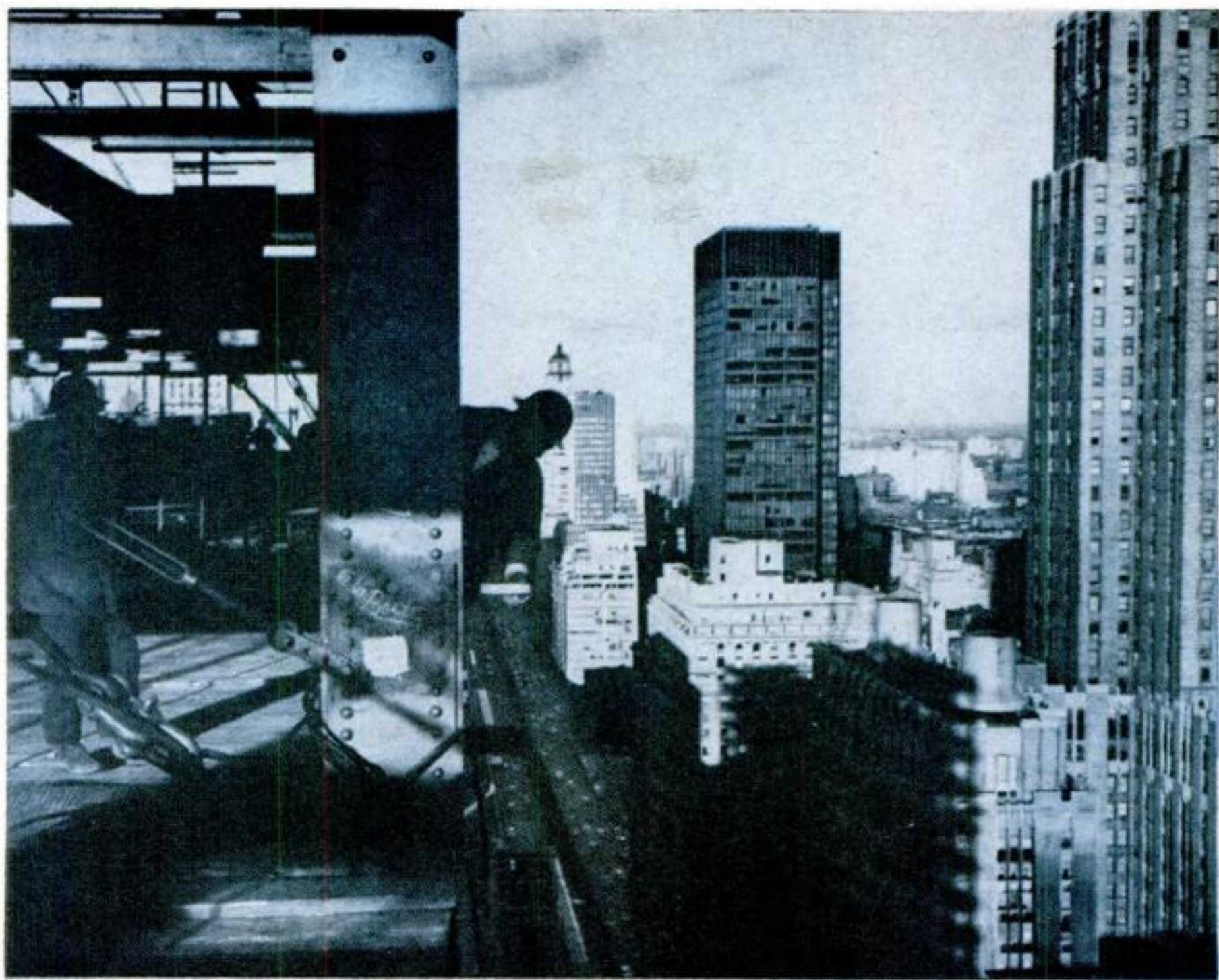


MISSILE HANDLER. This multipurpose vehicle is designed to replace individual lifting machines at missile bases. It has interchangeable front ends: a crane (left) to put missiles on launching racks, a fork (right) to unload packaged parts. Clark Equipment Co. calls it a Telefork.

TITAN. This huge elephant, in lifelike display at the Smithsonian Institution, is the largest known land animal in the world. It is 13 feet 12 inches high, 20 inches taller than the famous Jumbo, and weighed about 12 tons. It was bagged in Africa by J. J. Fenykovi, Hungarian engineer living in Spain.



PLANE POINT. The new 7,740-foot runway at left handles jet craft at Hong Kong Airport. It is built like a peninsula on 120,000 tons of crushed stone laid in the bay and surfaced with asphalt. The granite was taken from hills in the distance to provide a clear approach.



HIGH ABOVE NEW YORK, "plumber upper" sets new steel roughly vertical with plumb bob and rule.

How They Plumb a Skyscraper

Guided by a grid of lines visible only with a transit, a new building rises 720 feet with no more than a quarter-inch lean

THEY start plumbing a skyscraper on the ground before the first steel goes up. Surveyors mark off reference lines on the sidewalk, just outside what will be the building's walls. As the building rises, survey lines are transferred upward with it into the third dimension.

How do you transfer a line through empty space? The construction engineers do it by sighting along the sidewalk markings onto the walls of nearby buildings. Where the transit's cross hairs zero in, they nail a target. These first targets are used later to zero in a second set of

targets higher up. They in turn help establish a third set, and so on.

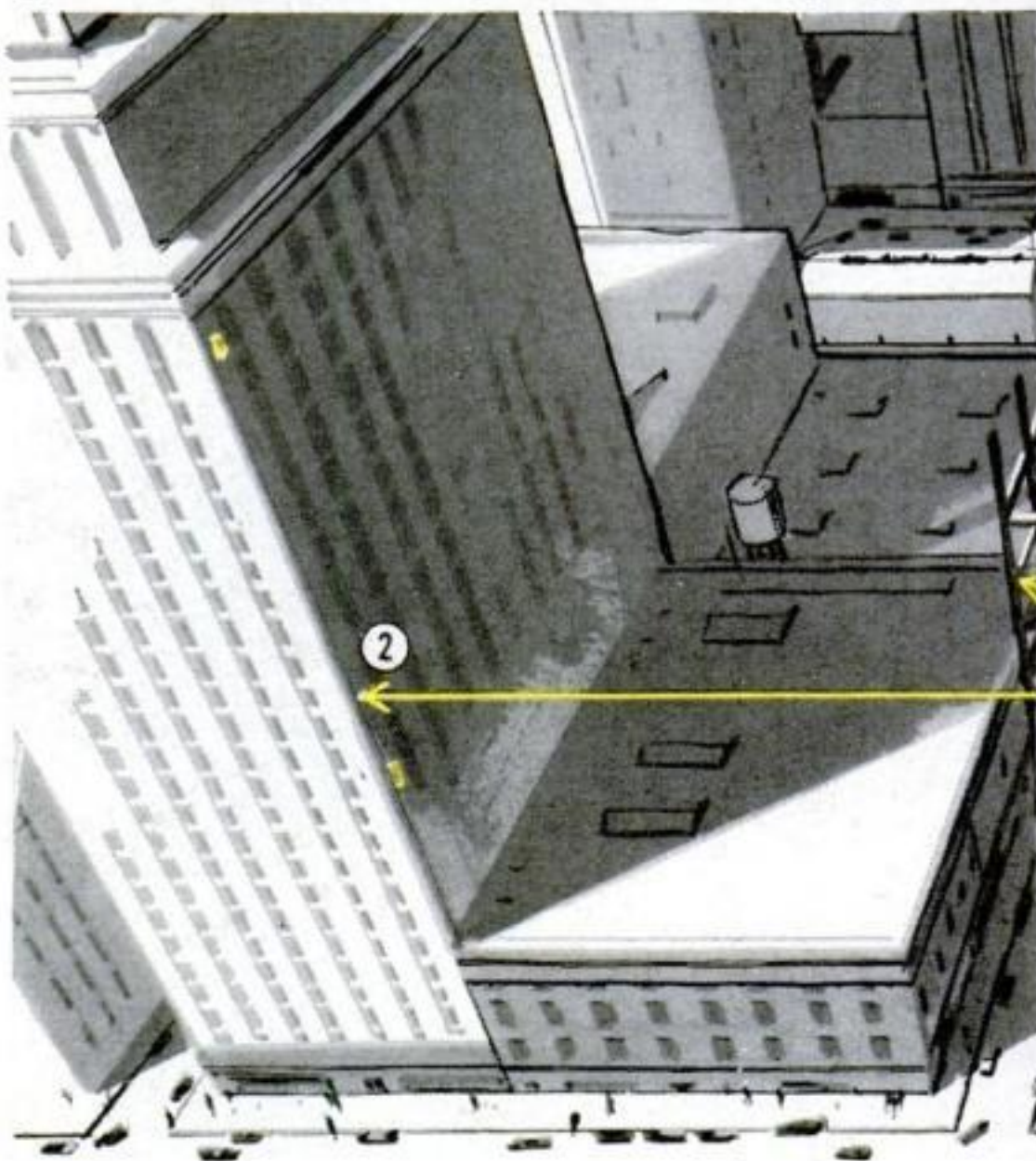
Take the 720-foot Union Carbide Building being built on New York's Park Avenue. A survey line was established for each north-south line of columns because of the 40-foot spans between them—too long to permit lining up by mechanical means. With the east-west lines, these formed a basic grid that was then extended at street level to 34 targets on adjacent buildings.

By the time steel reached the 16th-floor level, a second set of targets had to be nailed up. Many were put on roofs,

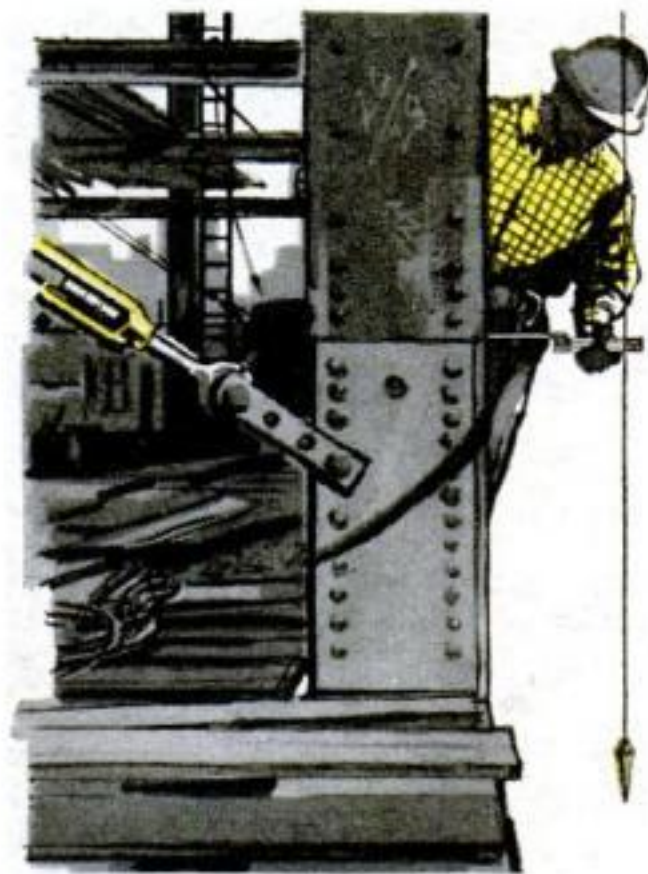
Pointing a skyscraper straight up: Close-ups,



1 SURVEY GRID, based on city records, is laid out along the property lines. Coordinates are scribed on the sidewalk, then extended to street-level targets nailed up on nearby walls.



2 SECOND SET OF TARGETS nailed on nearby buildings re-establishes survey grid at 16th floor as steel rises. To find buildings high enough, some targets must be placed blocks away.



3 "PLUMBER UPPER" sets columns roughly vertical as the bolting crew replaces temporary bolts with permanent ones. Nuts are hand-wrench tightened until engineers can check.

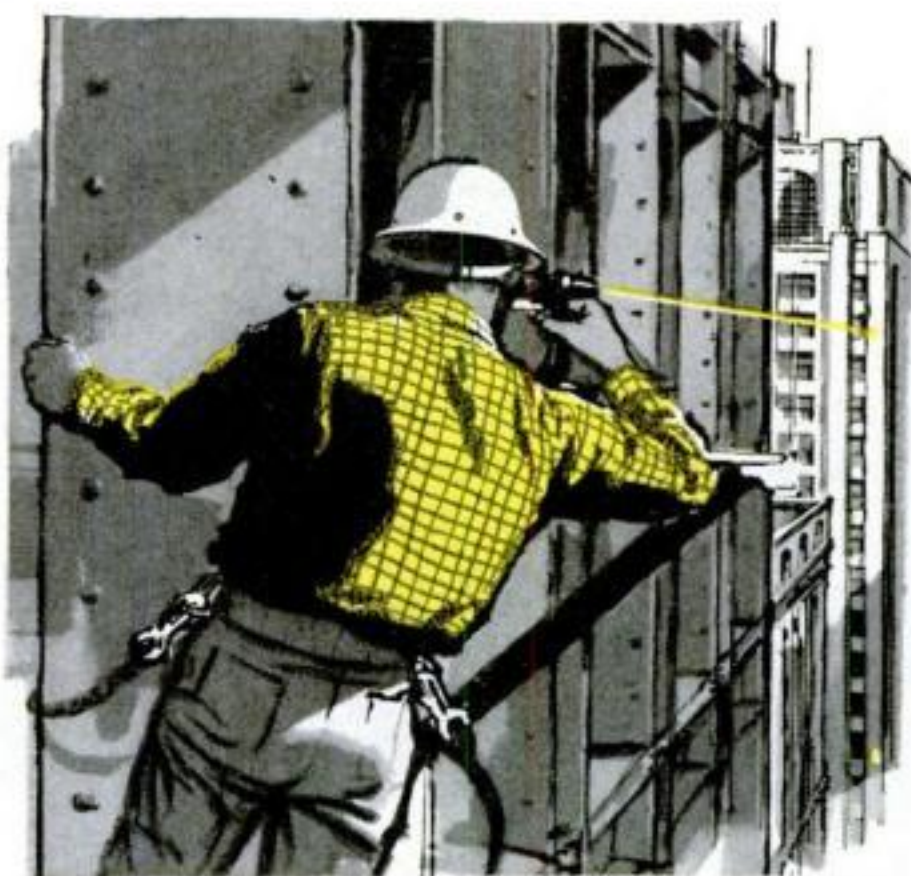
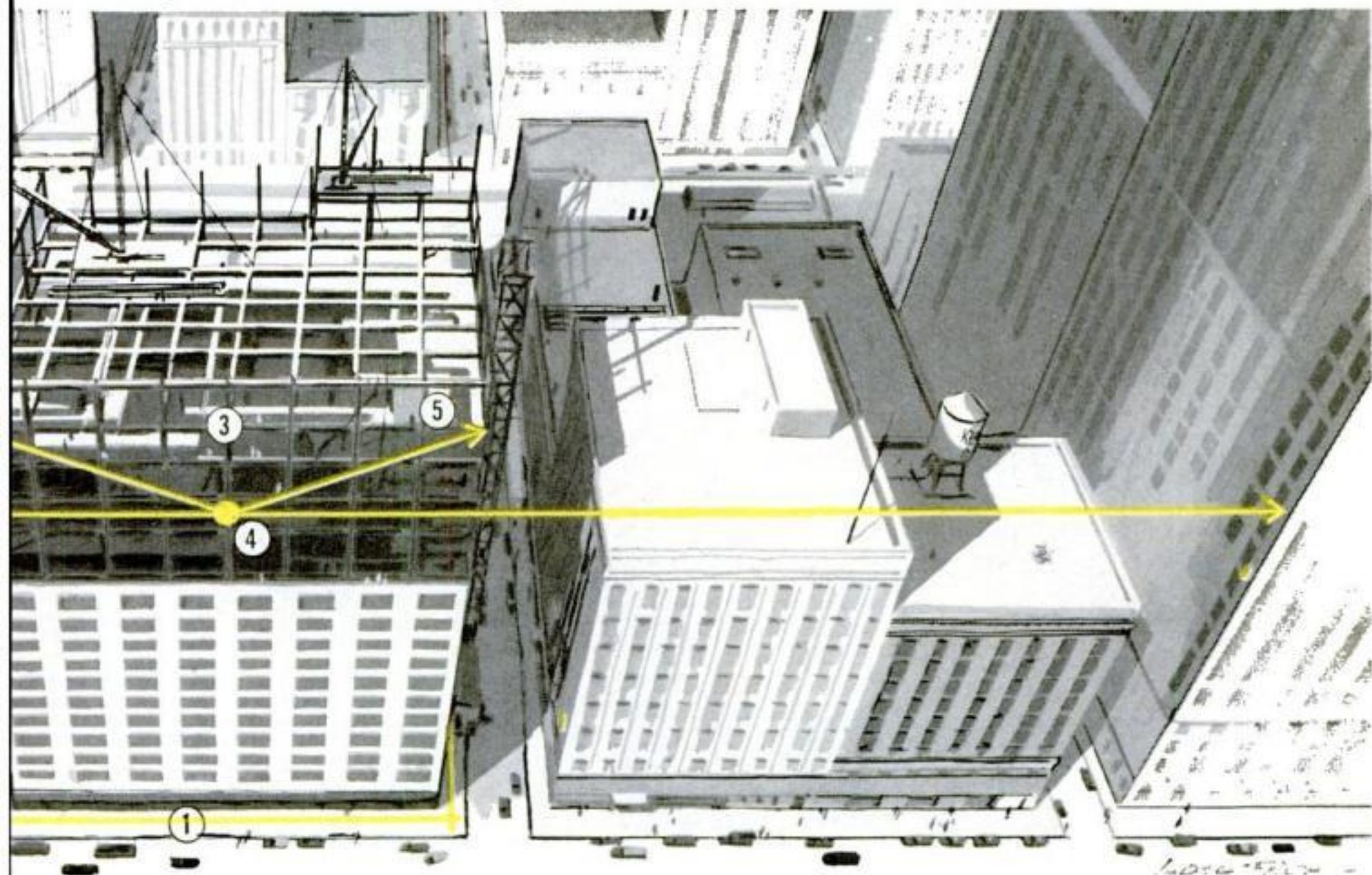
elevator towers and copings. Two for the west face of the structure were seven blocks apart—one on 42nd Street, the other on 49th.

Steel went up like this: A column two stories tall was lifted into place by der-

rick and bolted down, using temporary bolts and drift pins. Guy wires with turnbuckles connected the top of the column to the structure below.

Before the bolting crew replaced temporary bolts with permanent, high-tension

keyed to the Big Picture, show how it's done



4 SIGHTING ON TARGETS to north and south, engineer sights in transit on a survey line. Transit is now a precise distance from the center of previously plumbed column.

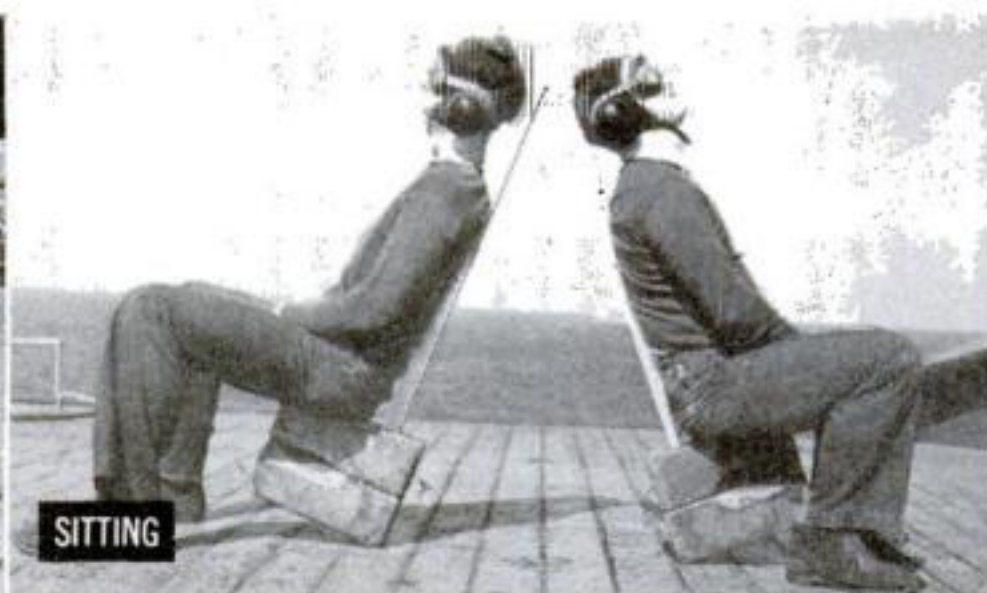


5 TRANSIT IS SWUNG UPWARD, where one end of rod is held at centerline of new column. Cross hairs must cut rod at same distance out from column as transit is from column.

ones, a "plumber upper" set the column roughly vertical by hanging a 30-pound plumb bob at the end of a 26-foot-long piano wire along the column. Bolts were then hand-wrench tightened.

When girders had been bolted across

the tops of a group of columns, an engineer checked the plumb with his transit. Columns that needed straightening were racked by twisting the turnbuckles on the guy wires. Finally, bolts were air-wrench tightened.—*Erik H. Arctander.*



RARE ALBINOS. A corn snake and snapping turtle (left), both pure white, are subjects of a study of albinism in reptiles and amphibians at Michigan State University. The snake came from North Carolina and the turtle from Canada. Their lack of color makes them easily visible to predatory animals; hence, it is believed, their rarity.

LAND BOAT. The truck-towed half ship at right got that way to avoid passing through East Germany. Because a section of the Elbe River would take the vessel into Red territory, it was cut apart, hauled in sections by road, reassembled later.



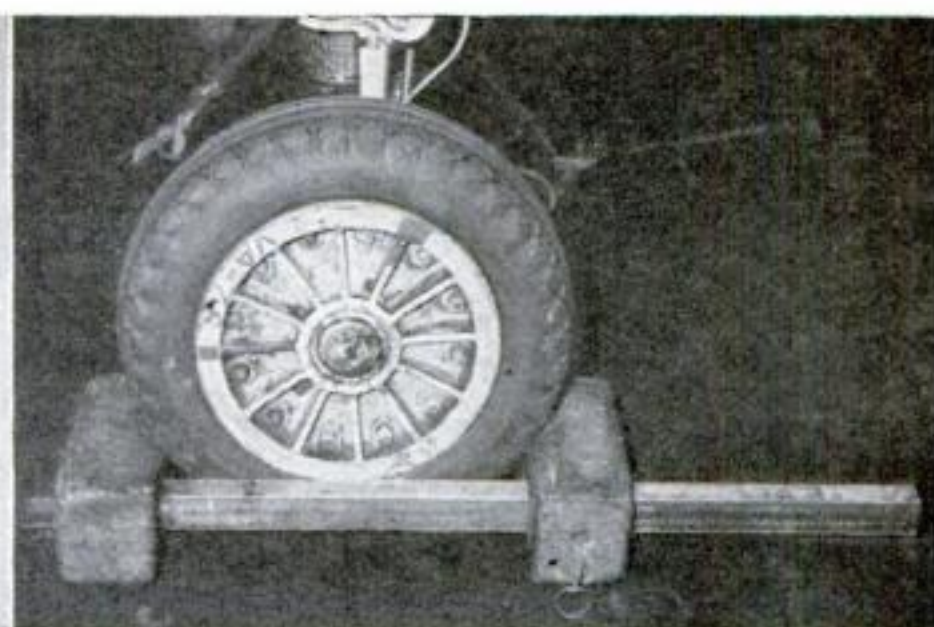
ROUNDHOUSE. British hotel operators are planning to build a modern hotel like the doughnut-shaped model at left on the Bath Road a mile from London Airport. It will be the first round hotel in Europe. Completely modern, it will contain 185 rooms with bath, all facing outside or on the circular court.



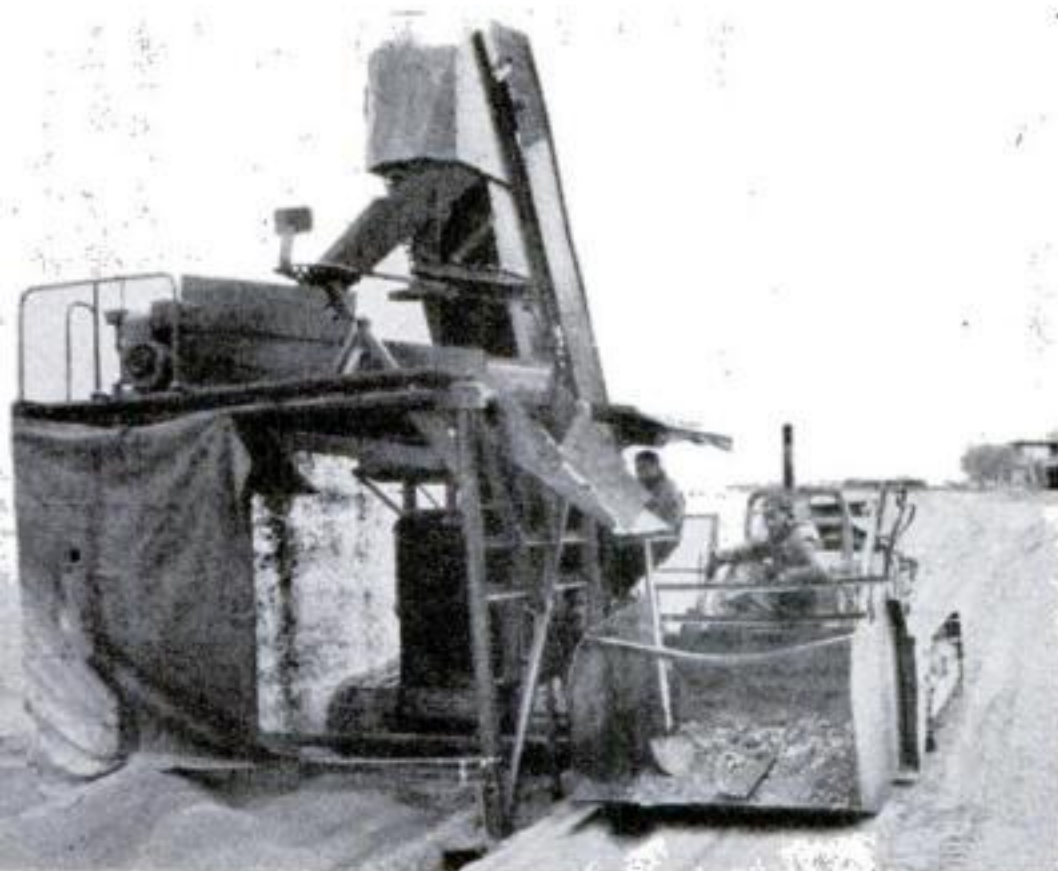
LEANING



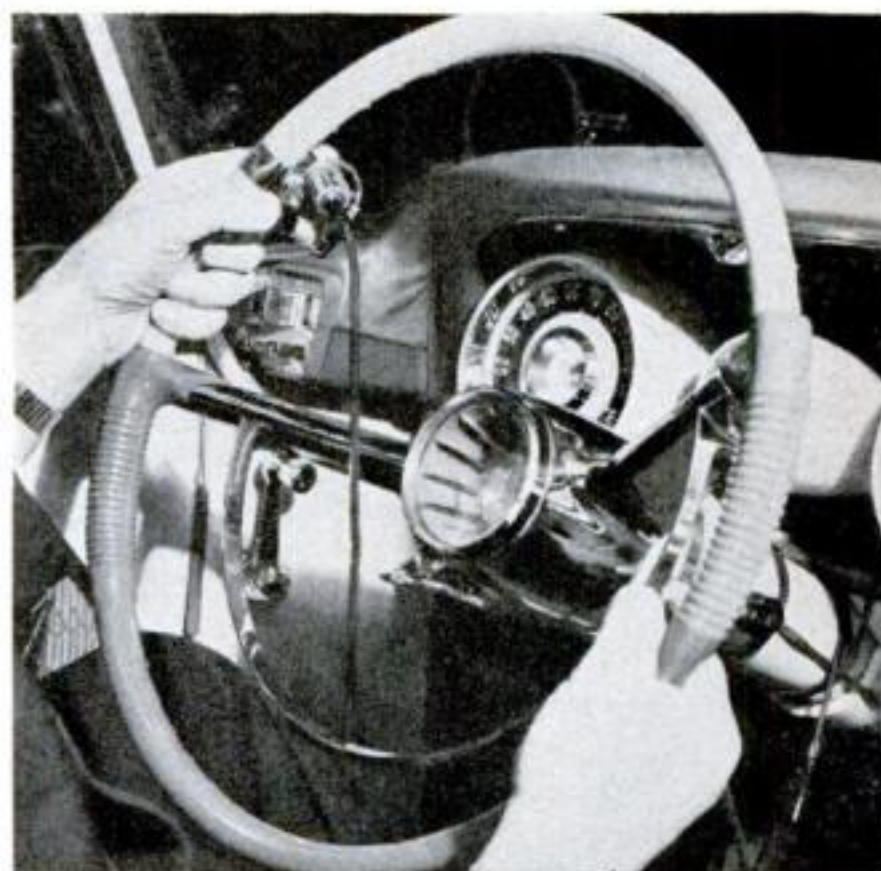
EXERCISING



WHEEL CHOCKS. In the Navy they are designated R-1730-242-9145-S 030 and intended to anchor landing gear on flight decks. But crewmen aboard the carrier *Intrepid* put them to offbeat uses at left while waiting for their planes to return. Oh, yes, the R-1730, etc., is the actual stock number—supply code.

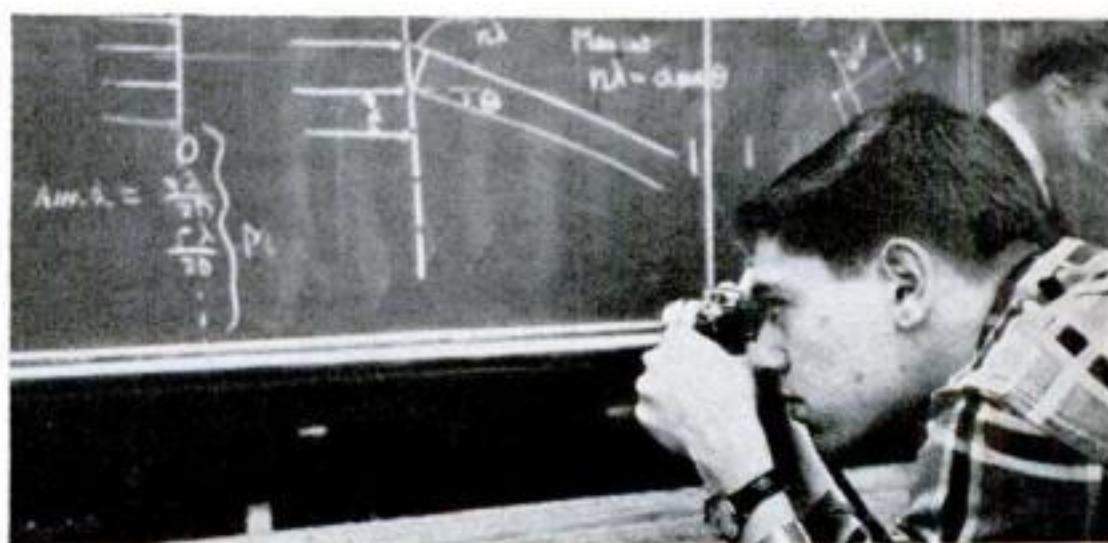


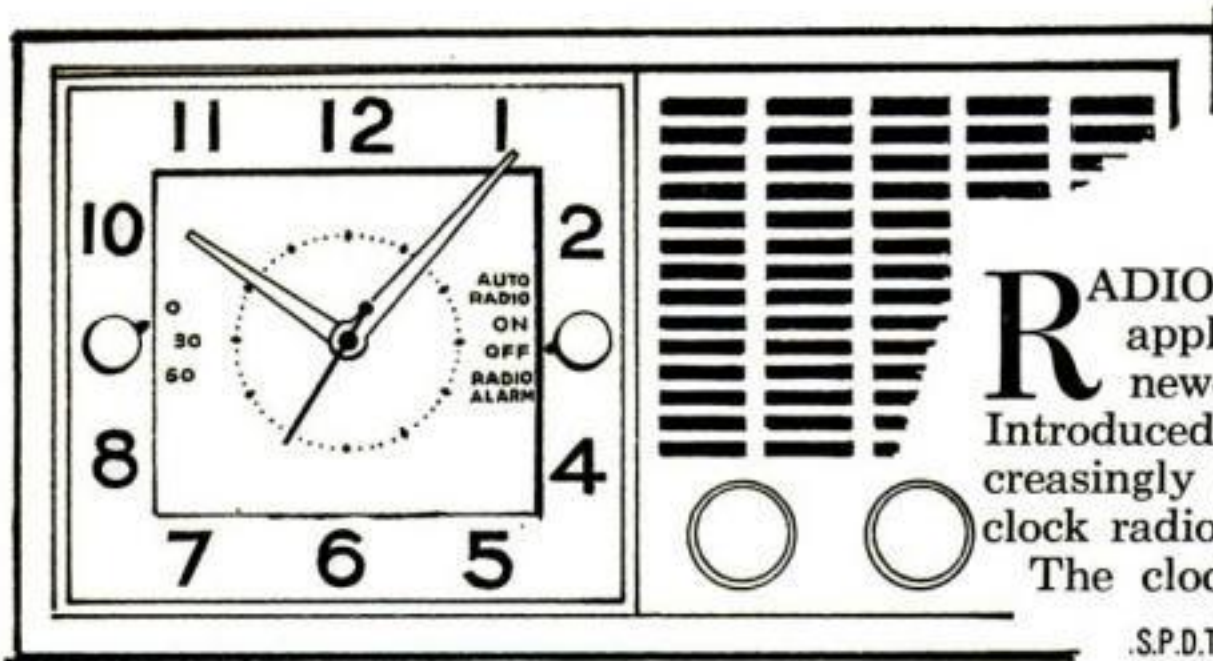
BEACH COMBER. This big machine hauls in bottles, cans and stones on the Lake Michigan beach at Milwaukee, screens back clean sand. A chute dumps refuse into a bin pulled by a second trailer.



SAFETY BUTTON. The steering-wheel attachment above is a Chicagoan's anti-sleep buzzer. Plugged into the car radio on a long trip, it sounds off if the driver nods and relaxes thumb pressure.

FASTER THAN HAND. Instead of laboriously taking notes in class at Columbia University, Roger Field photographs the blackboard (right) with a 35-mm. camera. Then the ingenious sophomore develops the film and makes 8-by-10 enlargements. He defrays expenses by selling prints to his classmates.





How a

RADIOS that turn themselves—and appliances—on or off are relative newcomers to the American home. Introduced in 1947, they've become increasingly popular. Last year 2,300,000 clock radios were sold by 25 makers.

The clock and timer mechanism de-

S.P.D.T. SWITCH—CENTER, OFF

How they're wired

THE CLOCK WORKS A SWITCH wired into one leg of the power line to the radio. Also across the power line is a convenience outlet for small appliances. Radio and outlet are turned on and off by the switch—a single-pole, double-throw unit.

POWER TO CLOCK MOTOR

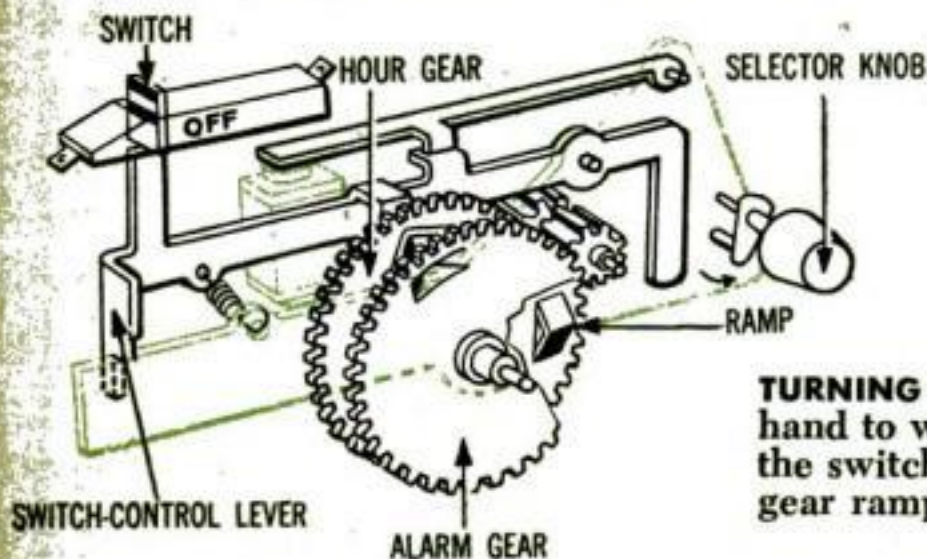
SHAFT SETS CLOCK AND ALARM HANDS



CONVENIENCE OUTLET

POWER TO RADIO

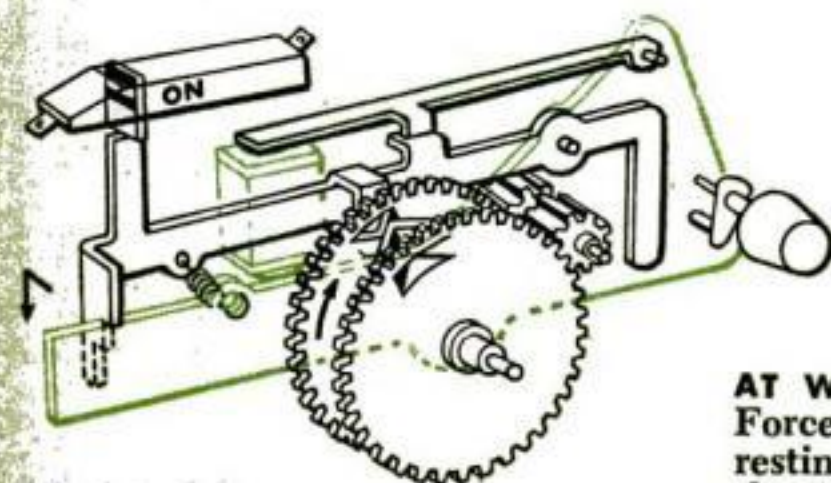
How a clock radio wakes you in the morning



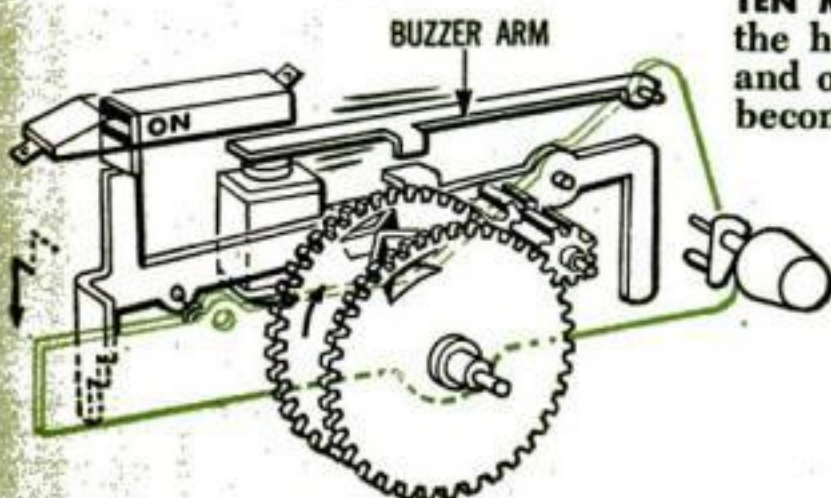
TURNING SELECTOR KNOB TO "RADIO-ALARM" and the alarm hand to wake-up time desired sets up the system. This moves the switch-control lever onto its bottom notch and the alarm-gear ramp a proper distance from the hour-gear ramp.



AT WAKE-UP TIME the alarm- and hour-gear ramps meet. Forced back, the hour gear nudges the switch-control lever resting against it. The lever drops onto its top notch, letting the switch move into lower ON position.



TEN MINUTES LATER, as ramps touch at their widest points, the hour gear nudges the switch-control lever farther back and off its top notch. When the lever drops, the buzzer arm becomes free to vibrate—and sounds off.



Clock Radio Works

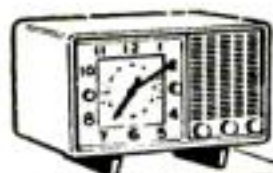
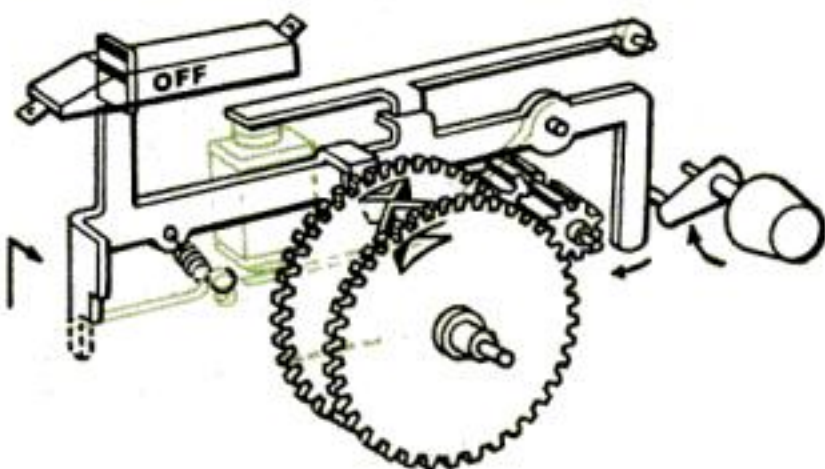
scribed below is a Telechron, made by General Electric. A pioneer in this field, Telechron is used in most clock radios.

By turning three knobs—two on the front and one in back—you can hand over most of the remembering chores to one of these electrical gadgets. A synchronous motor runs the clock and drives gears that operate a power switch. The knobs you turn in front determine when the switch goes on or off. The knob in back sets the alarm hand to the time you want things to happen.

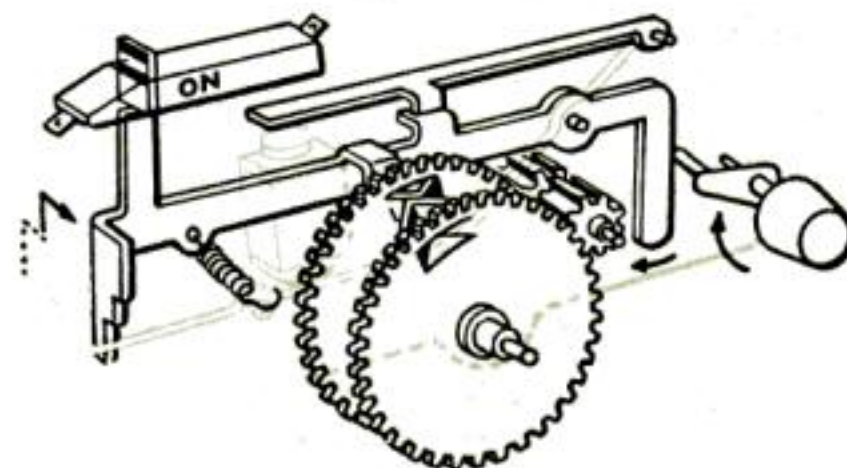
Clock mechanisms give little trouble. But there *is* a problem with the plastic knobs in front: Some energetic folks turn them too far and twist them right off the thin control shafts.

How you silence the buzzer and operate radio manually

TO STOP THE BUZZER you flip the selector knob to OFF. In turning, the selector shaft pivots the switch-control lever up two notches. Lever pushes the power switch OFF and blocks buzzer arm.



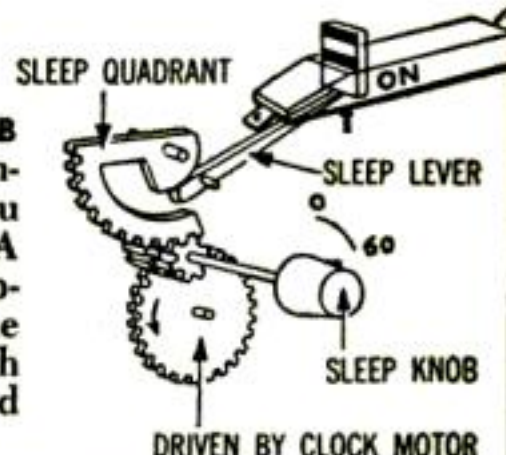
RADIO PLAYS AGAIN when you select the ON position. This pivots the switch-control lever up another notch, nudging the switch into its upper ON position.



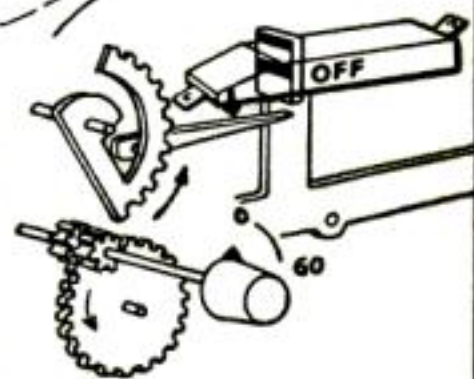
How the radio shuts off after you're asleep



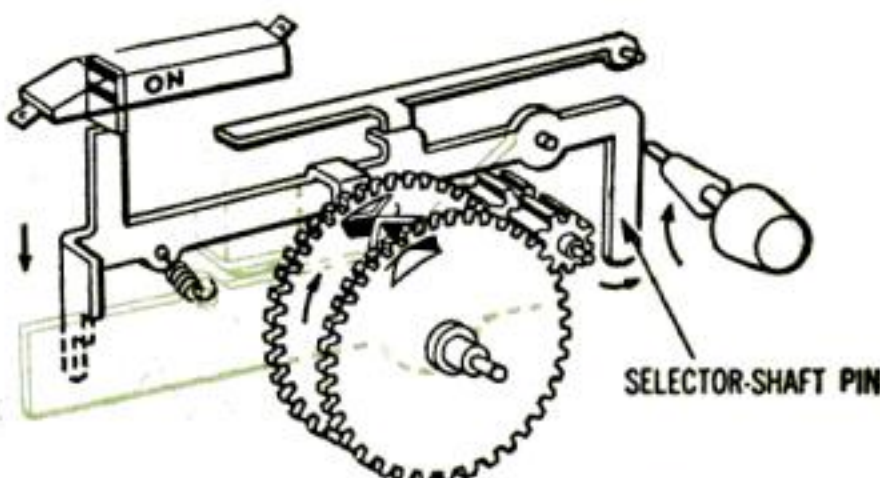
YOU TURN SLEEP KNOB to the number of minutes (up to 60) you want the radio on. A pinion on the sleep-knob shaft rotates the sleep quadrant, which pivots a lever upward against the switch.



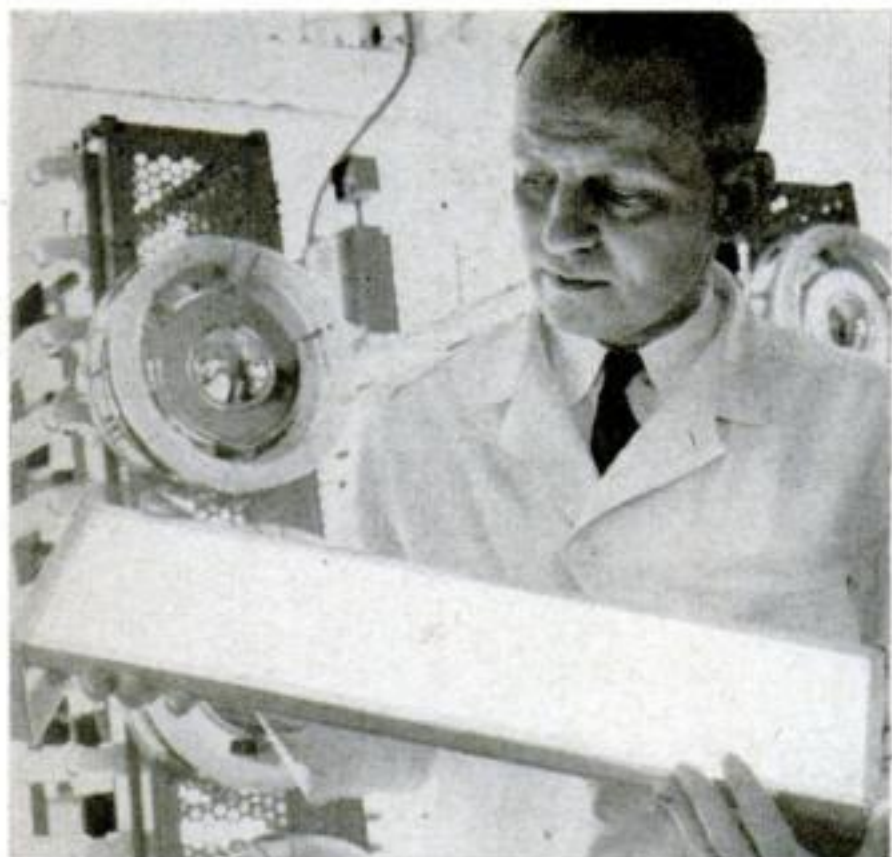
RADIO SHUTS OFF when the sleep quadrant rides off the clock-driven pinion. The quadrant flips, tilting the sleep lever down. This releases the switch, which drops into center (OFF) position.



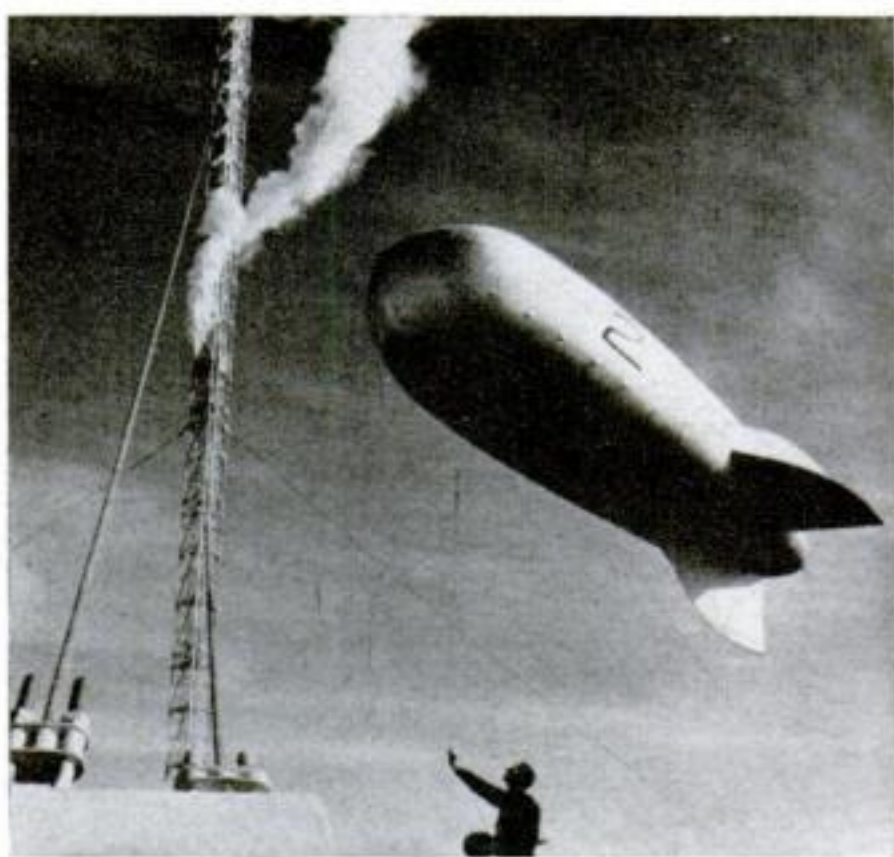
Radio ON, buzzer OFF



ON "AUTO RADIO," alarm- and hour-gear ramps meet as in "Radio Alarm." Switch lever drops, turning radio on. It's blocked from freeing buzzer by a selector-shaft pin.



FLAT FLUORESCENT. A labyrinth of passages sealed in a thin glass block (above) forms a path for an electric arc to light a wide area. Westinghouse developed this new fluorescent lamp.



WEATHER TEST. The blimp guided here at the Hanford atomic plant catches "fallout" samples from smoke sent from the tower. It determines conditions for releasing radioactive exhaust.



TAIL-FINNED MG. The new Magnette Mark III with a body designed by Pinin Farina has tail fins, a wraparound windshield and rear window, English leather upholstery and walnut trim. It can do 90 m.p.h., deliver up to 30 miles on a gallon of gas.

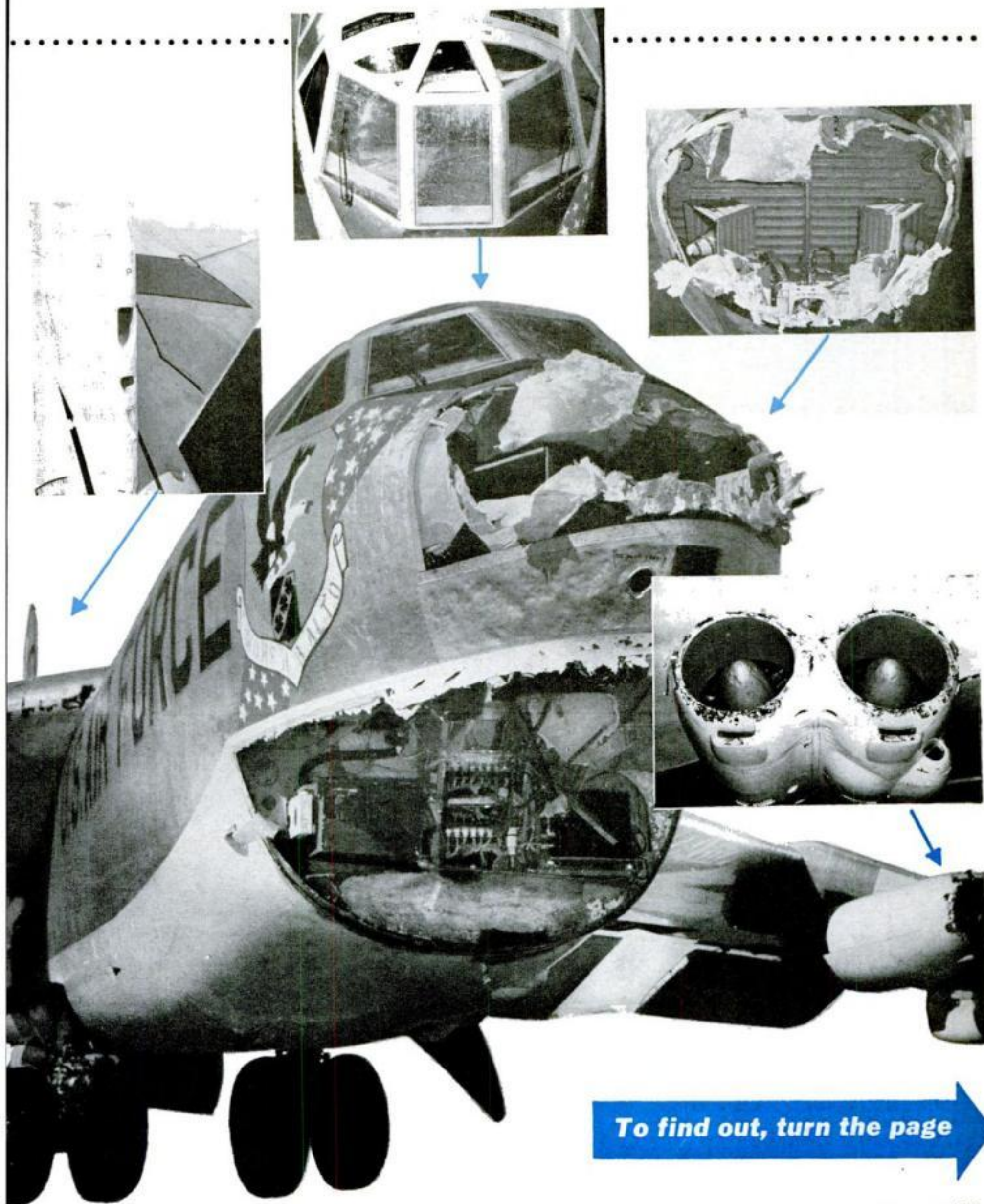


HOOK-AND-LADDER TRAILER. This 66-foot trailer rides on 32 tires, steers from the rear as well as the cab and has a telephone line between drivers. It was built by Trailmobile for hauling transformers in Spain.



NAVY SCOOTER. Latest of the Navy's fast research boats, the hydrofoil-equipped landing craft Halobates undergoes sea trials at left off Miami, Fla. It is powered by a gas turbine that in a series of test runs pushed it to speeds well over 30 knots.

What Happened to This Airplane?



Damage to plane pictured on preceding page came during a nightmarish 47-second flight through a hailstorm.



ON A ROUTINE TRAINING MISSION out of Carswell Air Force Base in Texas, an \$8,000,000 B-52 jet, piloted by Major W. F. Zerdecki, left the runway at two p.m. on October 21, 1958. It was raining lightly as the ship took off. Weather radarscope at the base indicated that a severe storm was brewing.



MINUTES AFTER TAKEOFF, the plane ran into the weather front. Texas-sized hailstones—big as baseballs—pelted the ship; at an air speed of 400 m.p.h., the impact was terrific. The windshield was smashed, the radar nose torn off; leading edges of both wings badly dented. Most of the instruments were dead.



THE BOMBER LURCHED BADLY. The air-speed indicator was useless. Zerdecki, aware that the jets, too, might conk out, radioed Carswell that it might be necessary to abandon the craft. The crew received bail-out instructions. But the engines continued to run, and Zerdecki chose to attempt a landing.



BACK AT CARSWELL, Brig. Gen. Nils Ohman, head of the 19th Air Division and Zerdecki's commanding officer, took charge of tower operations. A KC-135 tanker was located 90 miles south of the base. It was ordered to rendezvous with the crippled bomber and assess the external damage suffered.



TANKERMEN REPORTED that the landing gear and flaps on the bomber still seemed to be operational. While the B-52 crew tested the ship's instruments, the tanker personnel relayed their own readings so the two could be correlated. The tanker then flew even with the B-52 so Zerdecki could gauge air speed.



ZERDECKI CIRCLED over Carswell to lighten fuel load, then made a low pass over the tower. There were no wing holes to prevent cutting air speed for landing, towermen noted. The pilot came in safely, to receive his C.O.'s praise for "an outstanding piece of flying." Zerdecki's comment: "Routine."



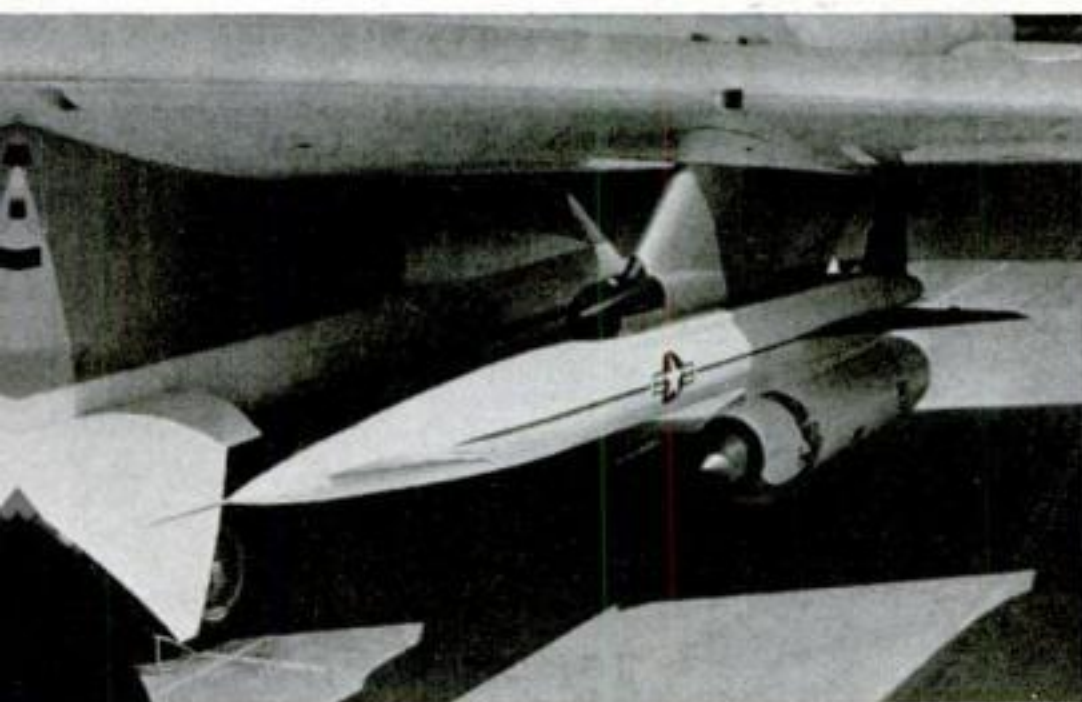
COMFY COP. Warm in winter, cool in summer, the policeman here operates traffic signals from an air-conditioned booth at a busy street intersection in Rome. If tests are favorable, the booths may be installed at all main corners.



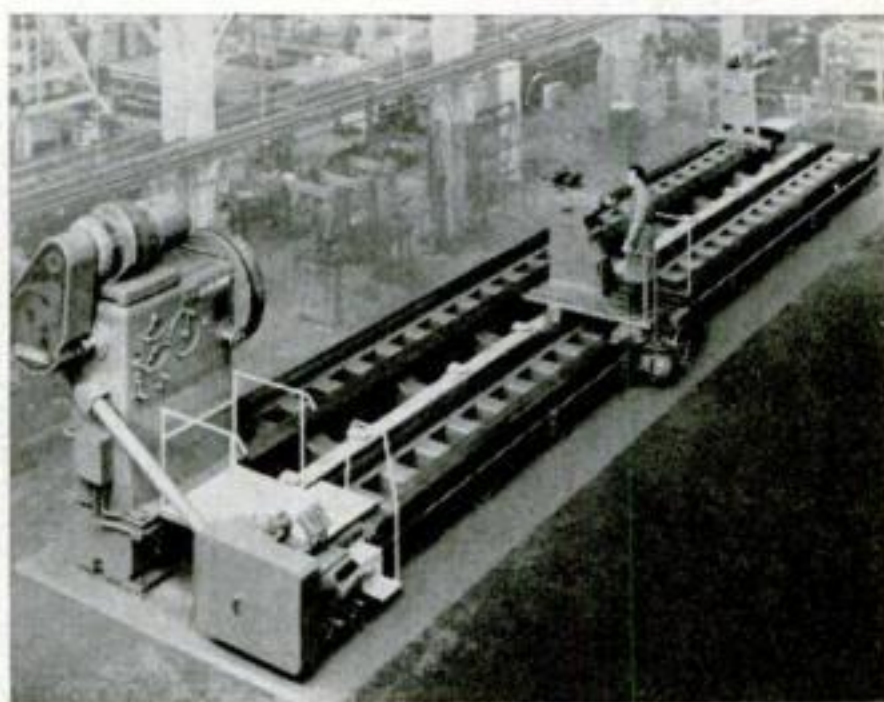
JET PIPELINE. Aluminum underground pipe is laid above at Atlanta's municipal airport to fuel Delta Airline DC-8 jets from tank trucks 150 feet away. Intervening space is used for loading planes.



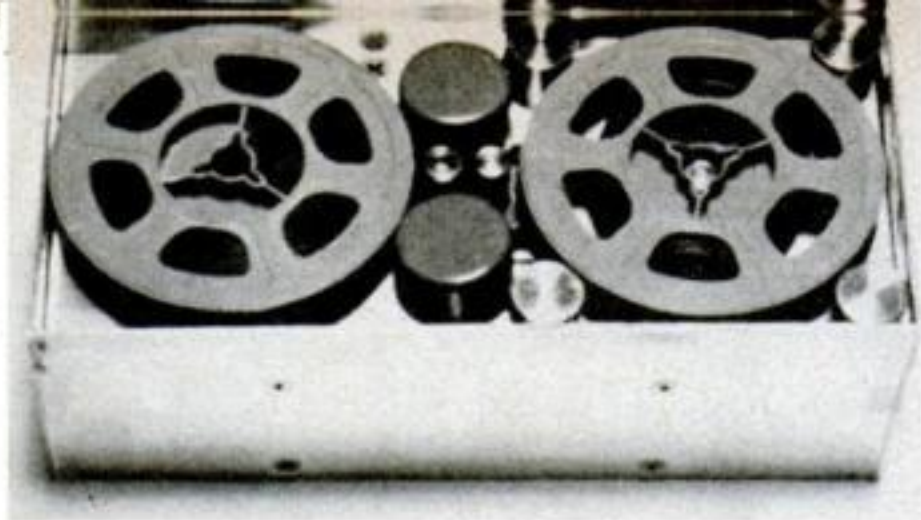
TRAILER FILLING STATION. A trailer contains office and rest rooms for a filling station at Belleville, Ill. It's set on a concrete foundation.



HOUND DOG FLIES. First photograph of the new Hound Dog air-to-ground missile now being air- and ground-tested by the Air Force. It is shown in takeoff position under the wing of a B-52.



ROCKET LATHE. This giant lathe was built by the LeBlond Machine Tool Co. for missile maker Aerojet-General. It has twin beds side by side, first in the U.S., and can handle work 45 feet long.



SMALL VOICE. This tape recorder, so tiny it would fit in a kitchen matchbox, won a miniaturization award for Keith O. Johnson, Stanford University student.

It is built of a small movie reel and war-surplus electronic parts, measures two by three by $6\frac{1}{4}$ inches, runs for 90 hours on self-contained batteries, uses 30 minutes of $\frac{1}{4}$ -inch tape.



MUSIC IN THE EAR. So travelers who like radio can listen while they ride, Italian express trains have individual speakers built into the seats. Special programs are broadcast for each train.



CANTILEVER CRANE. The 223-foot arm of a 167-foot-tall crane swings a 250-ton test load above in a circle. On a wharf in Belfast, Northern Ireland, it's set on solid concrete and steel piles.



HANDYMAN. This mechanical slave is the final version of a GE robot [PS, June '58] designed to work on "hot" parts of atomic aircraft. Controlled by an engineer (left), it is nimble enough to spin a hula hoop, handle a hammer (above).

MECHANICS AND HANDICRAFT

GAS IN A BUGGY?
Two gallons will fill 'er up to fire the five-hp. tractor engine. Side view below shows engine in place between the buggy rails. Turn page for details.



Antique car or modern replica? You'll have to look sharp to tell. There's a growing fad for building—

New Cars in the Old-Time Style

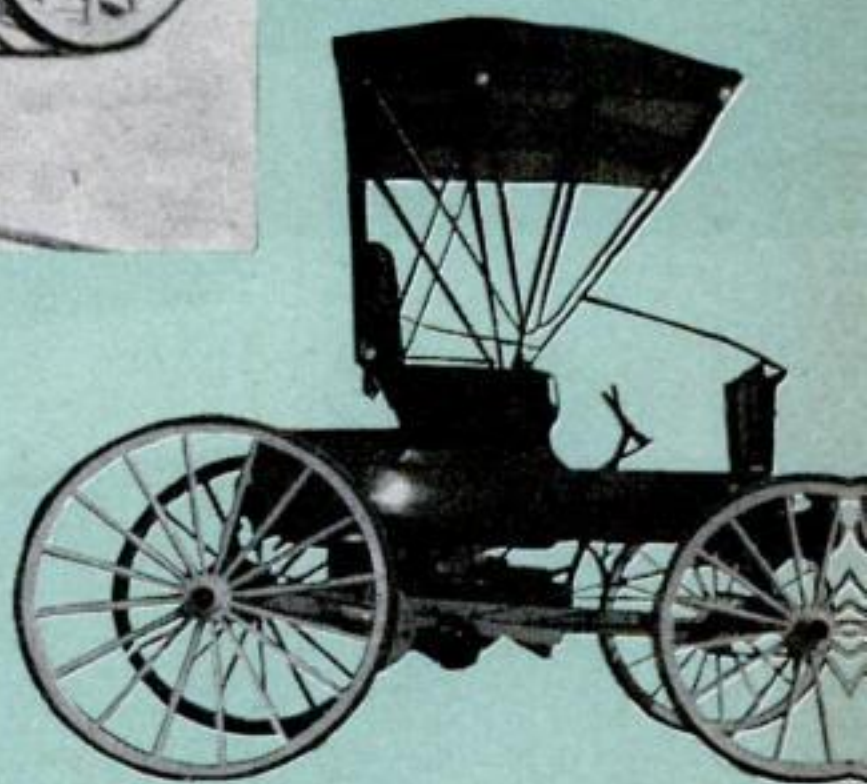
By Herbert R. Pfister

NOSTALGIC old cars are becoming more popular every day, but they're also getting scarce.

Virtually all the original old models have been dragged out of barns and restored, leaving a large and growing group of old-car enthusiasts with nothing to get enthused about.

But imagination often takes over where the law of supply and demand cannot be broken, and the old-car lovers are finding a happy substitute—*new* old cars.

Already there are three active groups of



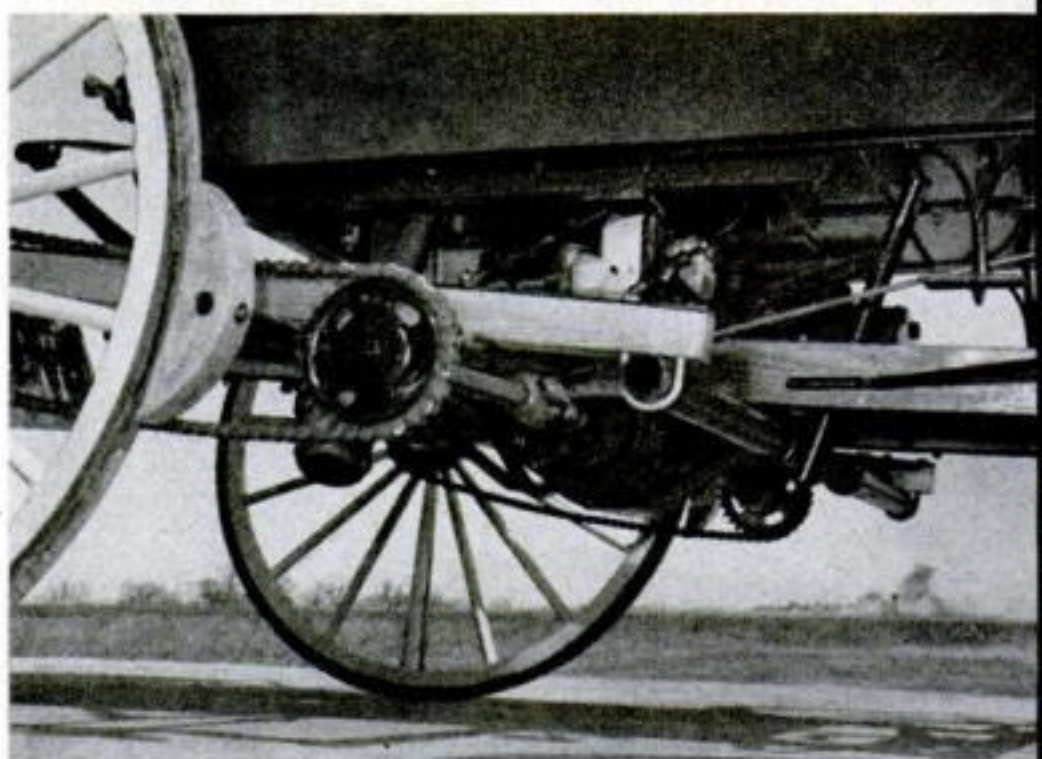
new-old-car builders: those who convert an old buggy by installing an engine; those who build cars from scratch, working from old-car plans; and the commercial builders, who operate busy factory production lines for a lucrative market.

The horseless carriage shown on this and the facing page is an excellent buggy conversion. Lyle Gilliom of St. Louis built it from an old buggy he found in a Missouri barn. Fitted out with front-wheel kingpins, a tiller bar and a five-hp. engine, the buggy kicks up a spry 15 m.p.h. on its original wheels. The wood-spoked wheels were sent to a wagon maker who cut down their diameter and added rubber tires.

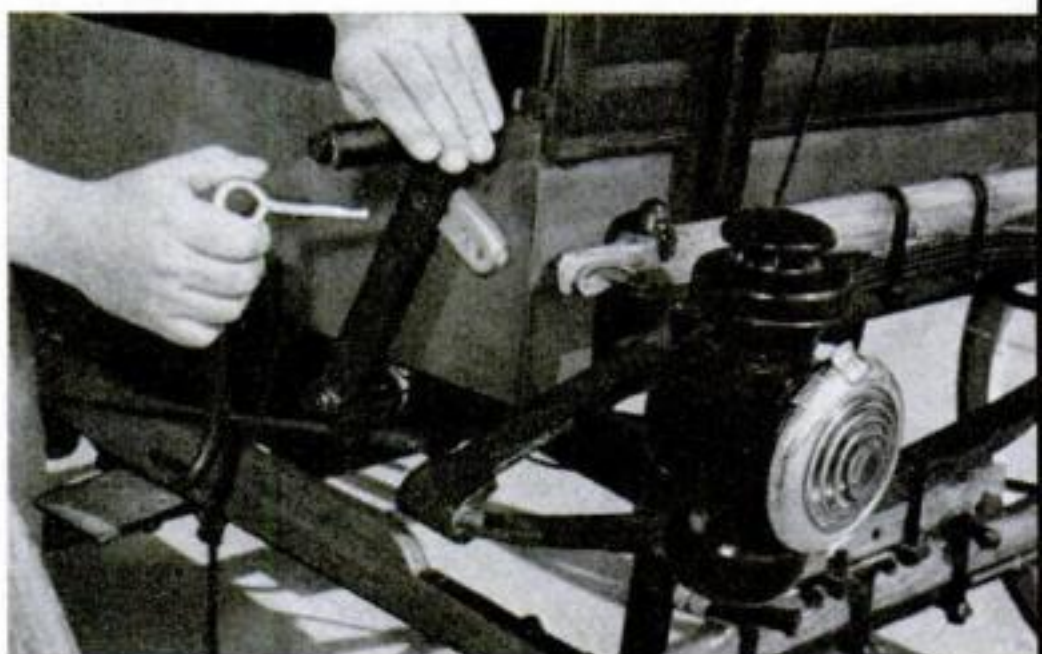
In Westfield High School, in New Jersey, Bjorne Tonneson, the woodworking-shop instructor, and Robert Della Russo, the auto-maintenance instructor, merged their classes to build an old car from scratch (see following pages). Wood-shop students fabricated the graceful plywood body and applied a hand-rubbed finish, while auto-shop students built the chassis

Before: the horseless carriage and its engine

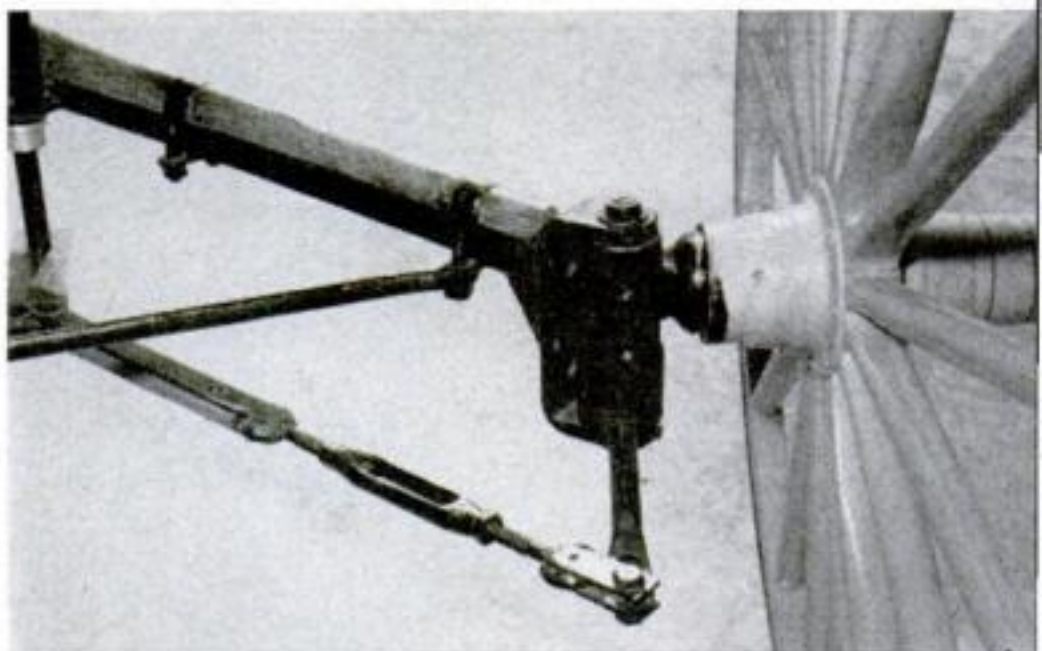
OLD PEERLESS BUGGY, built 50 years ago by the Joseph W. Moon Buggy Co. of St. Louis, is shown before conversion. The five-hp. engine of a Gravelly lawn tractor (bottom) was fitted to buggy as shown at right.



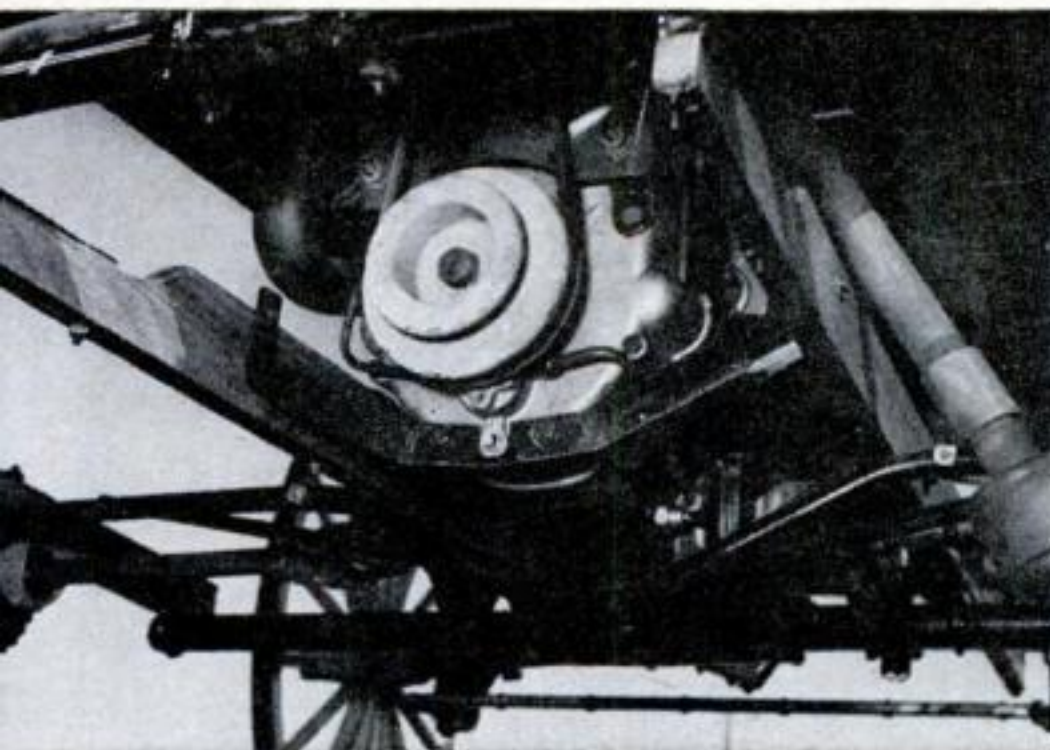
DRIVE SPROCKETS for car shown on preceding page are turned by universal joints mounted on axles that once drove tractor wheels. Ball-bearing pillow blocks bolted to oak outriggers on the chassis support the sprocket shafts.



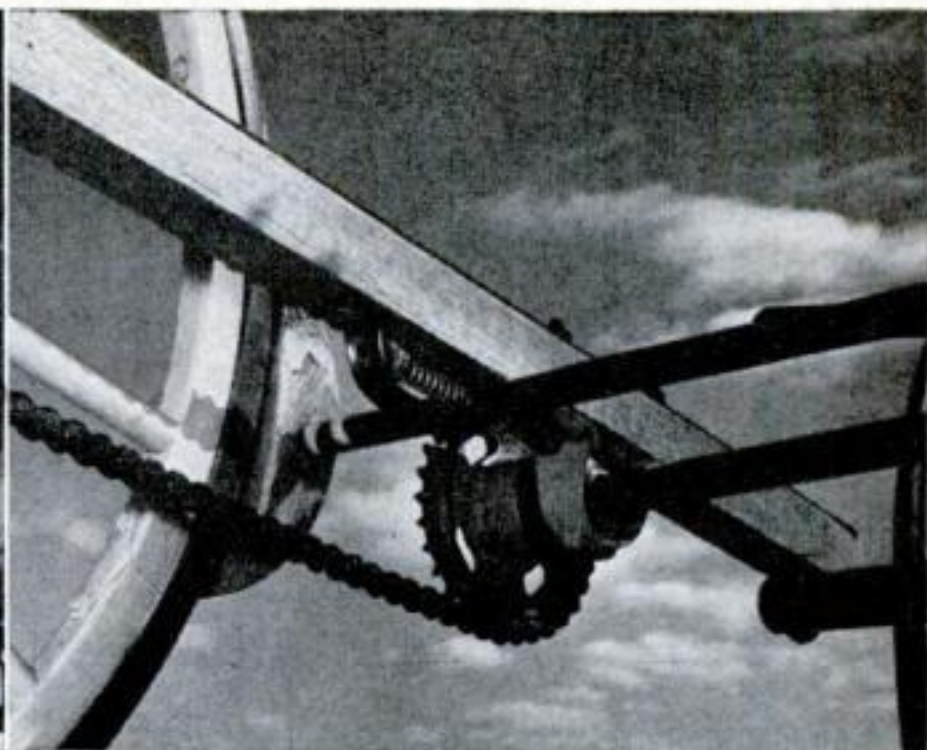
BRAKE PEDAL is also the parking brake when depressed and pinned in position with an eyebolt stored behind the dash. Downshifting the engine's integral planetary transmission to low speed provides unusual braking effect.



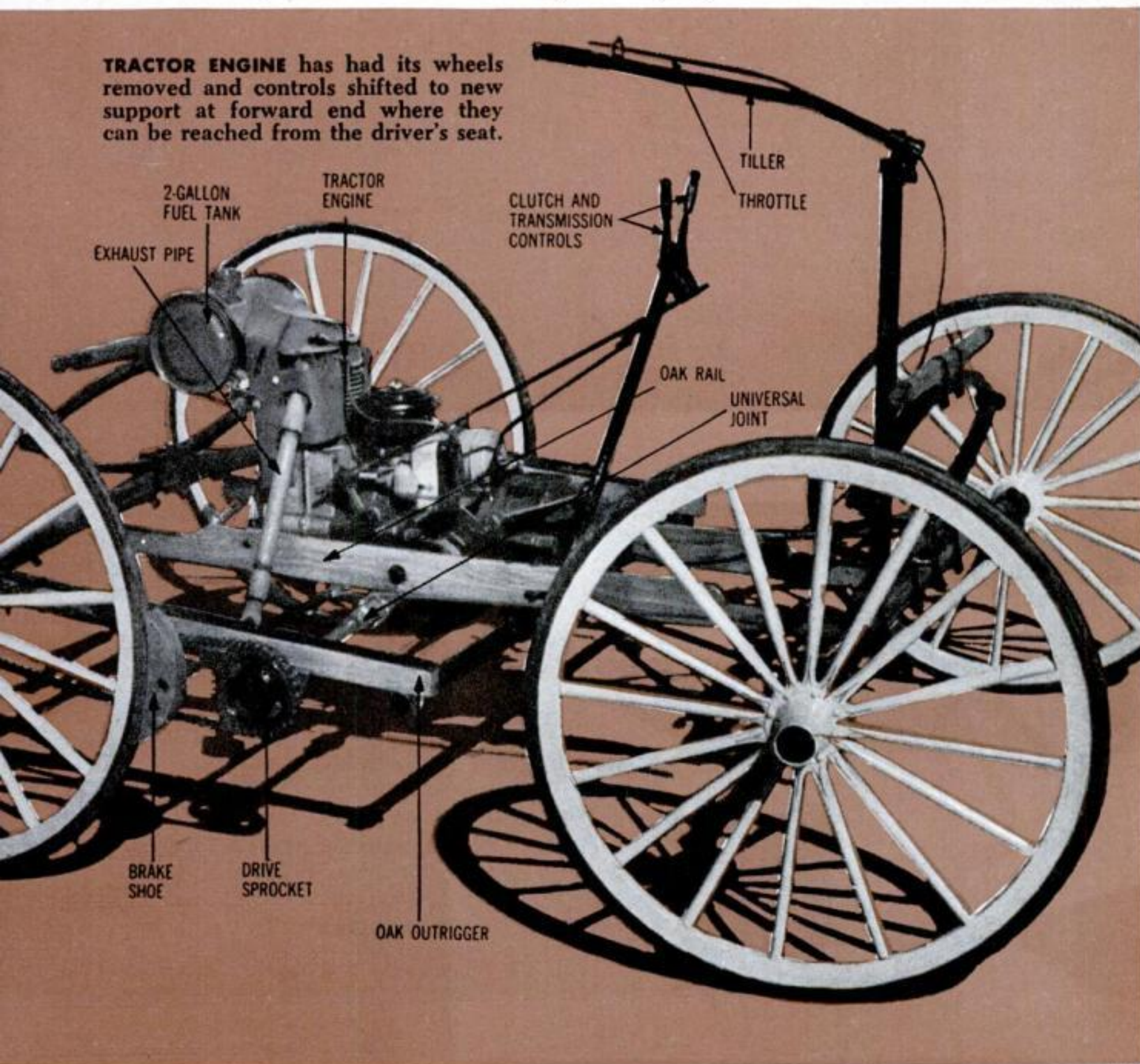
KING BOLTS were fitted to U-shaped brackets welded to the original axle. Original wheel spindle was cut off and welded to kingbolt bushing. Old central pivot was bolted together to hold the axle in a straight-ahead position.



ANGLE IRON, bent to shape and bolted between oak rails, supports rear of engine. An iron-pipe cross member supports the front. Main rails and outriggers are attached to the rear axle to keep it from shifting under strain of a hard pull.



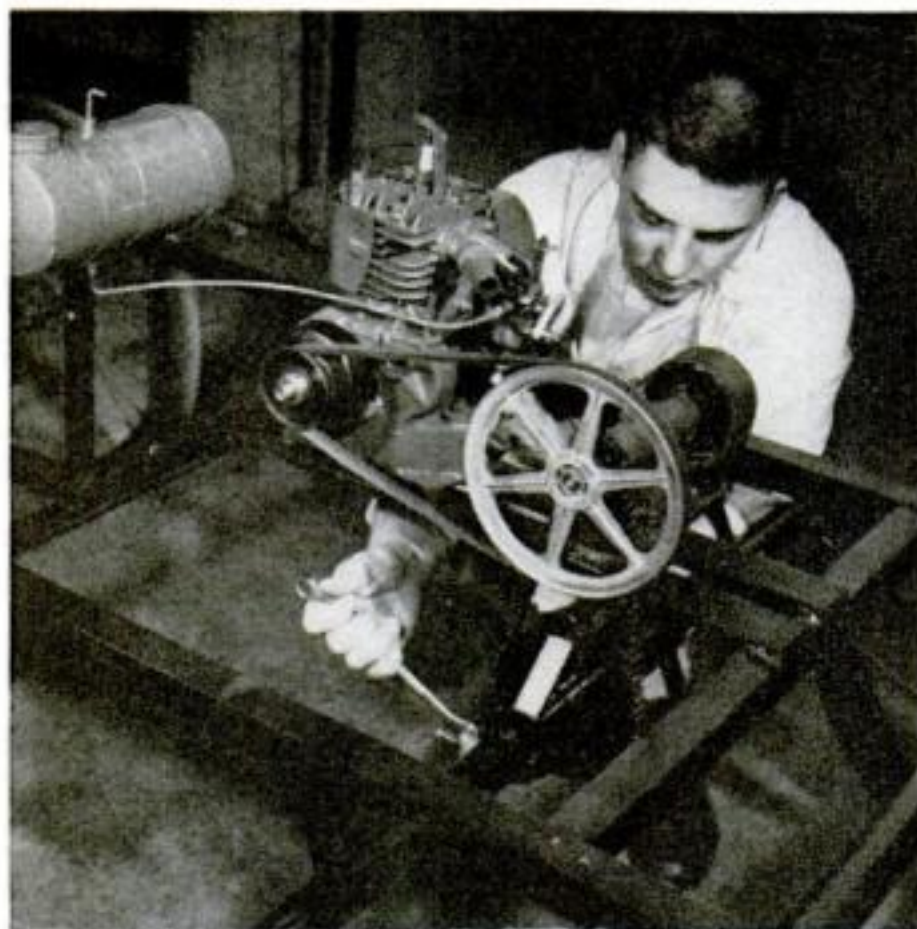
BRAKE SHOE on each side is forced against rear wheels by stiff cross rod operated by pedal at side of body. Cross rod slides inside a door handle bolted to underside of each outrigger. Springs hold shoes off wheels when not in use.



TRACTOR ENGINE has had its wheels removed and controls shifted to new support at forward end where they can be reached from the driver's seat.

- 2-GALLON FUEL TANK
- TRACTOR ENGINE
- EXHAUST PIPE
- CLUTCH AND TRANSMISSION CONTROLS
- TILLER
- THROTTLE
- OAK RAIL
- UNIVERSAL JOINT
- BRAKE SHOE
- DRIVE SPROCKET
- OAK OUTRIGGER

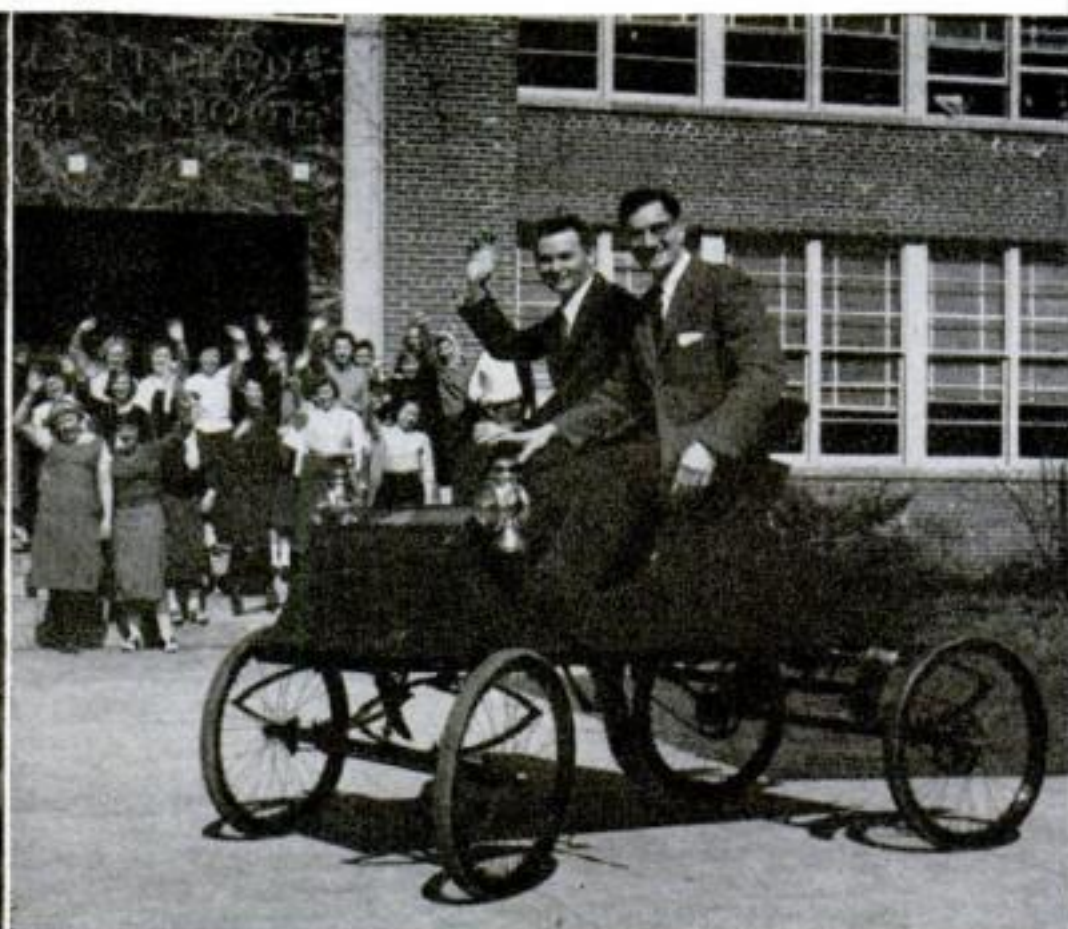
This car, built from scratch, won a special award



OUTSTANDING PROJECT at the New Jersey Vocational and Industrial Arts Convention in Ashbury Park, the "Delton" was built entirely by high-school students. Frame is 1½" angle iron.

and running gears. The car, affectionately called a Delton (a combination of the names Della Russo and Tonneson), is not a copy of any particular old vehicle. Plans were drawn by the school's mechanical-drawing class.

The Delton's chassis is a simple frame of 1½" angle iron. A Mercury centrifugal clutch mounted on the shaft of a little two-hp. engine engages automatically as engine speed is increased. Power is transmitted by belt to a pulley on a countershaft, then by sprocket and chain to the drive shaft. A bevel-gear differential permits a sprocket on each end of the



CENTRIFUGAL CLUTCH enables car to accelerate smoothly, and it corners nicely on turns at 15 m.p.h. Above: teachers Bjorne Tonneson and Robert Della Russo, who supervised students.

drive shaft to power rear wheels individually.

Ordinary 26" bicycle wheels were used on the car after removing the small-bore bearing races and turning duplicates to fit the ¾" axle shafts. A 4" steel disk was brazed to the inside of each rear-wheel hub and a standard 9" bicycle sprocket was bolted to each disk to drive the wheels.

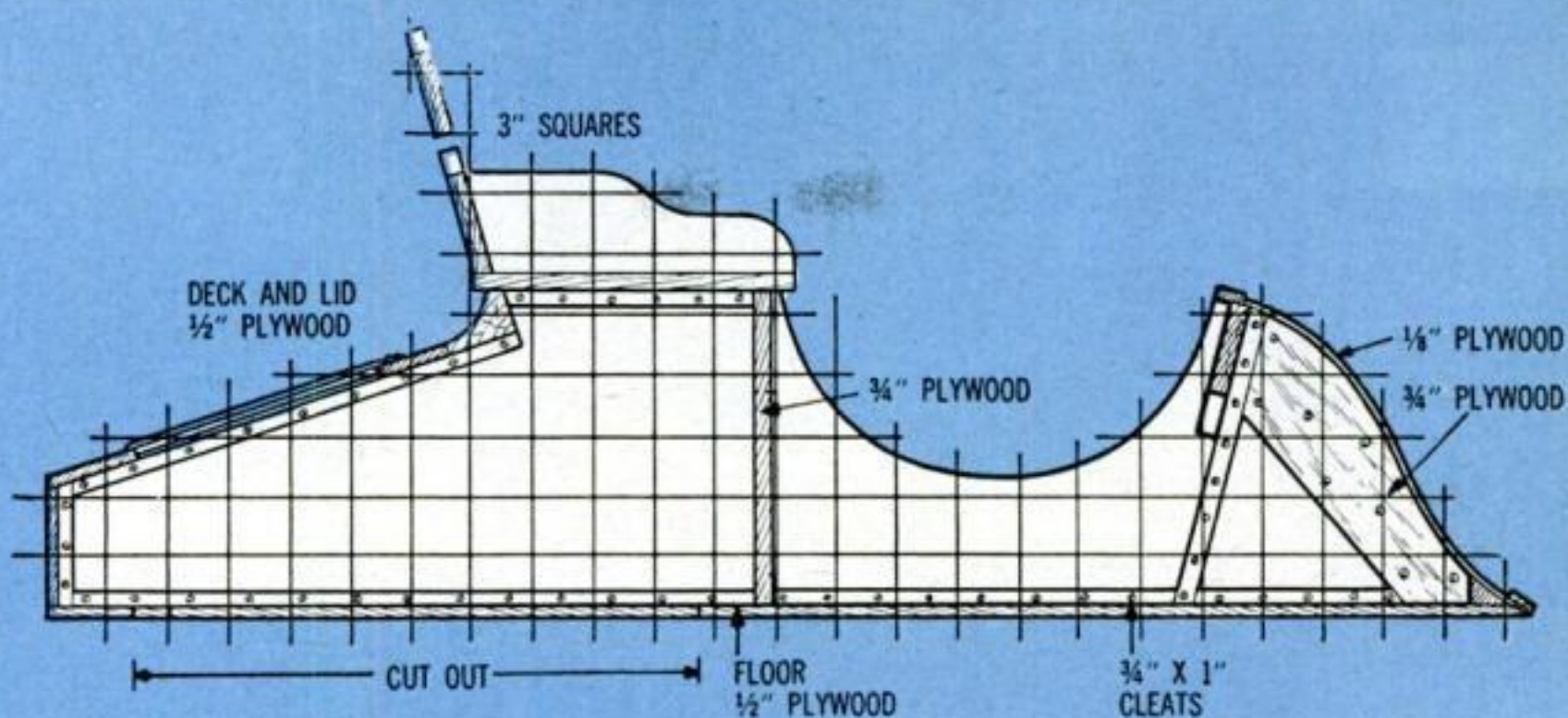
Steering stability was built in by tilting back the front axle for caster. Welding the kingbolt bushing slightly off plumb provided camber. Adjustable clevis ends on tie rods set toe-in.



To Get Complete Car Plans

LIKE to build this car? The drawing on the opposite page provides enough general information on parts and assembly so that you can build one like it. But for exact details and dimensions of every part you'll have to make, plus step-by-step assembly instructions, you may want a blueprint. How do you get one?

Send \$1 to: OLD CAR PLANS
Popular Science Monthly
355 Lexington Ave.
New York 17, N.Y.

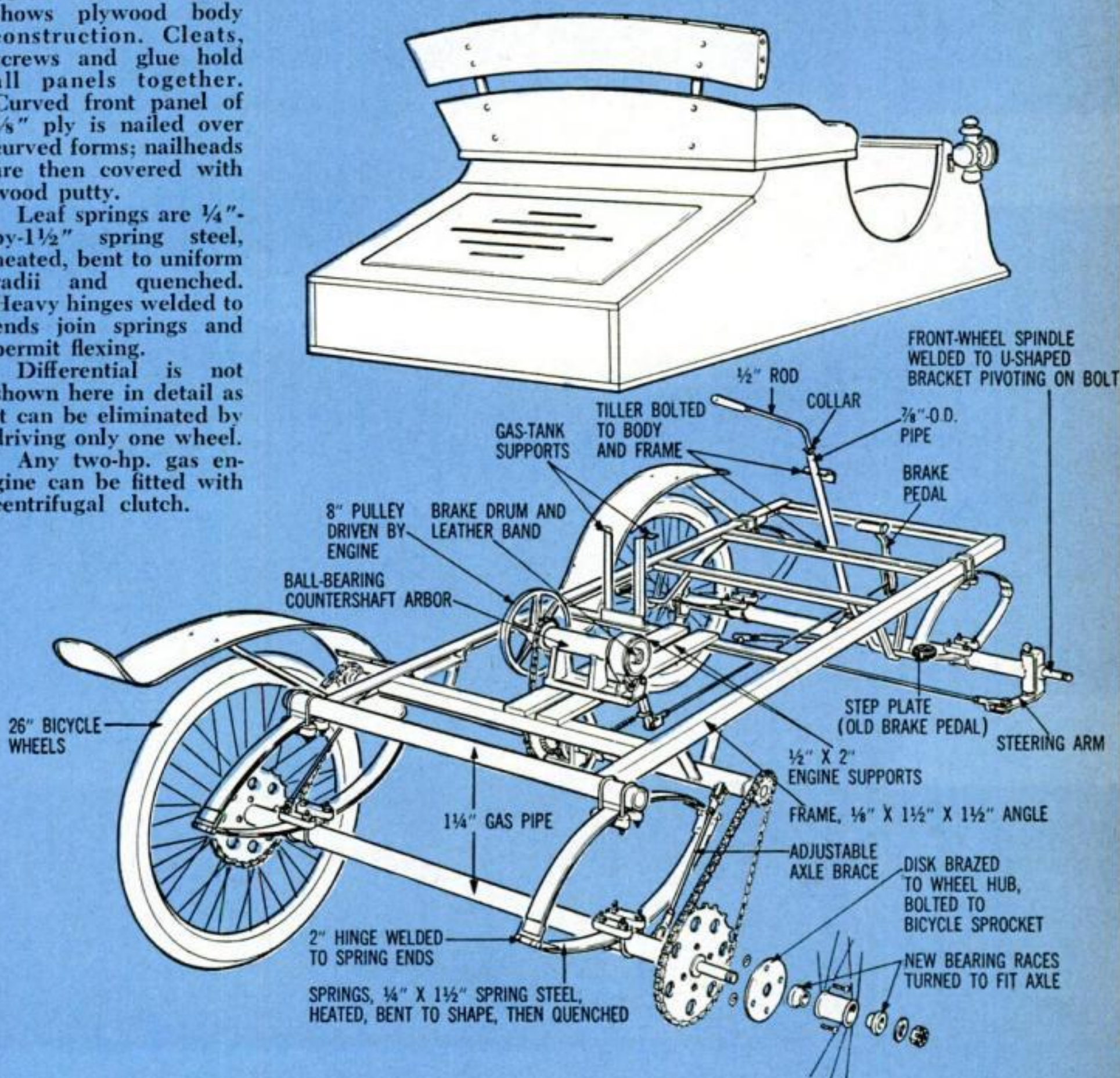


CUTAWAY OF DELTON shows plywood body construction. Cleats, screws and glue hold all panels together. Curved front panel of $\frac{1}{8}$ " ply is nailed over curved forms; nailheads are then covered with wood putty.

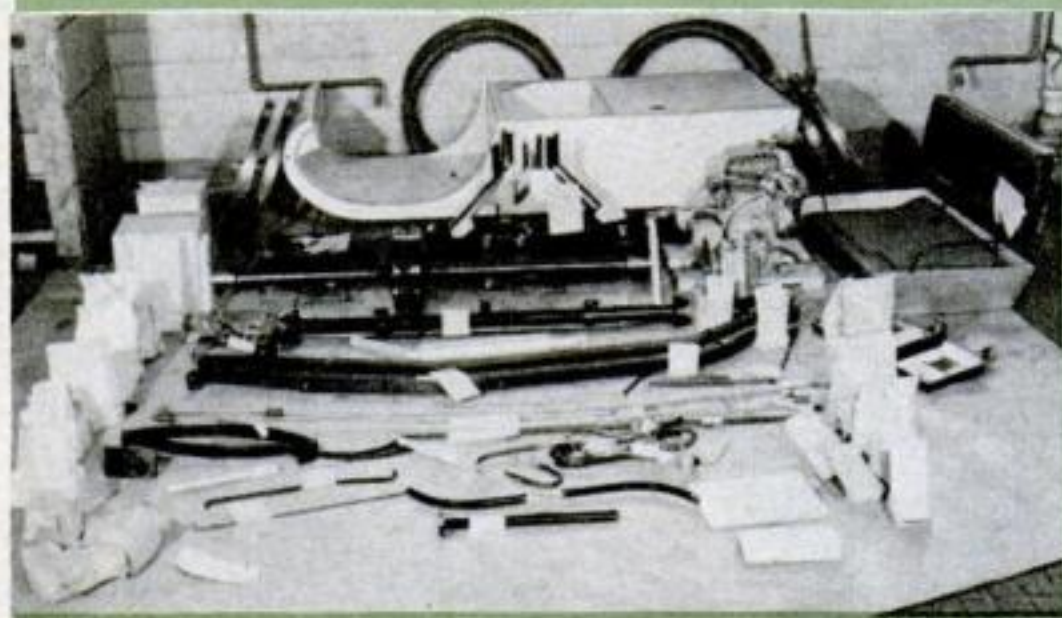
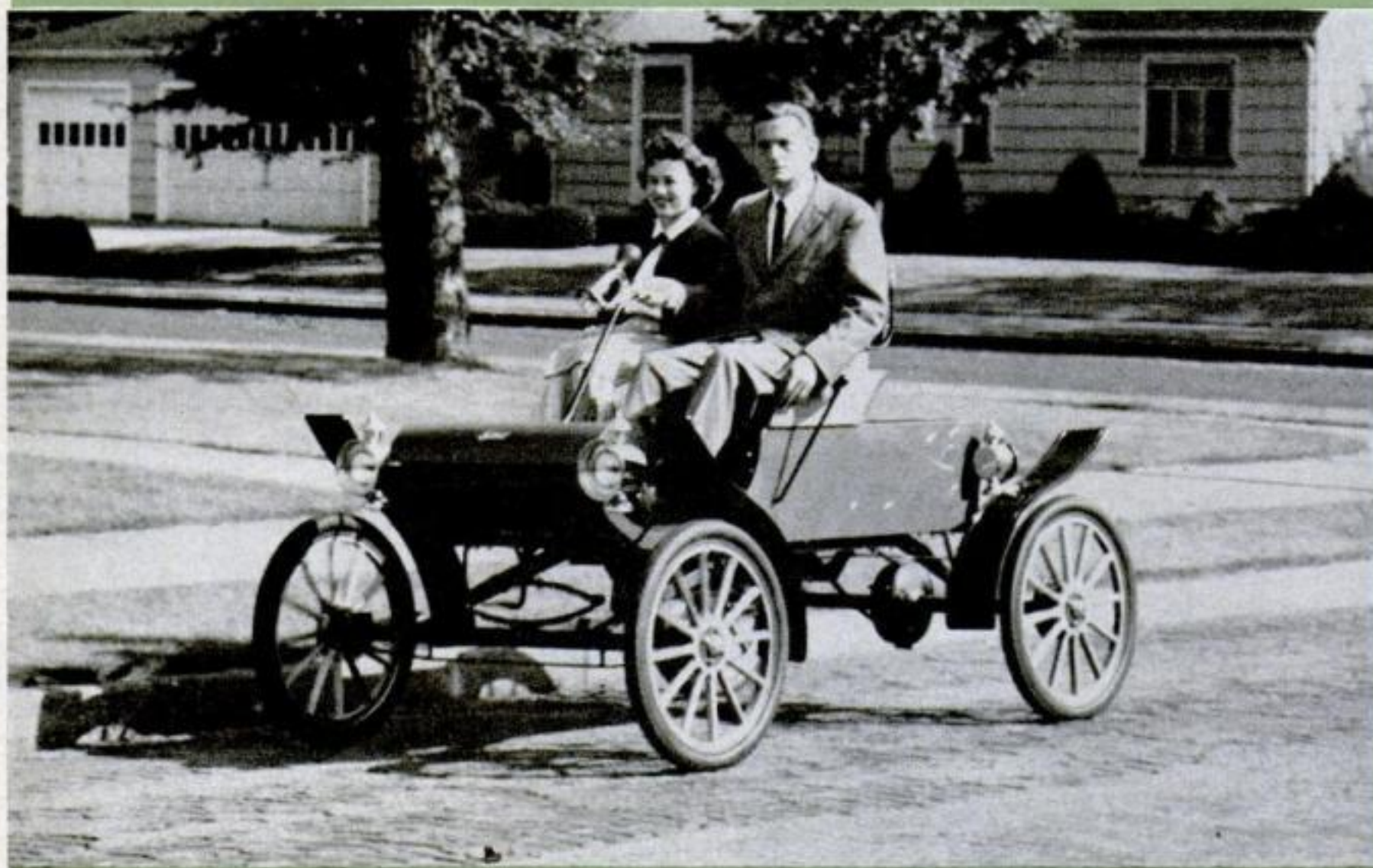
Leaf springs are $\frac{1}{4}$ "-by- $1\frac{1}{2}$ " spring steel, heated, bent to uniform radii and quenched. Heavy hinges welded to ends join springs and permit flexing.

Differential is not shown here in detail as it can be eliminated by driving only one wheel.

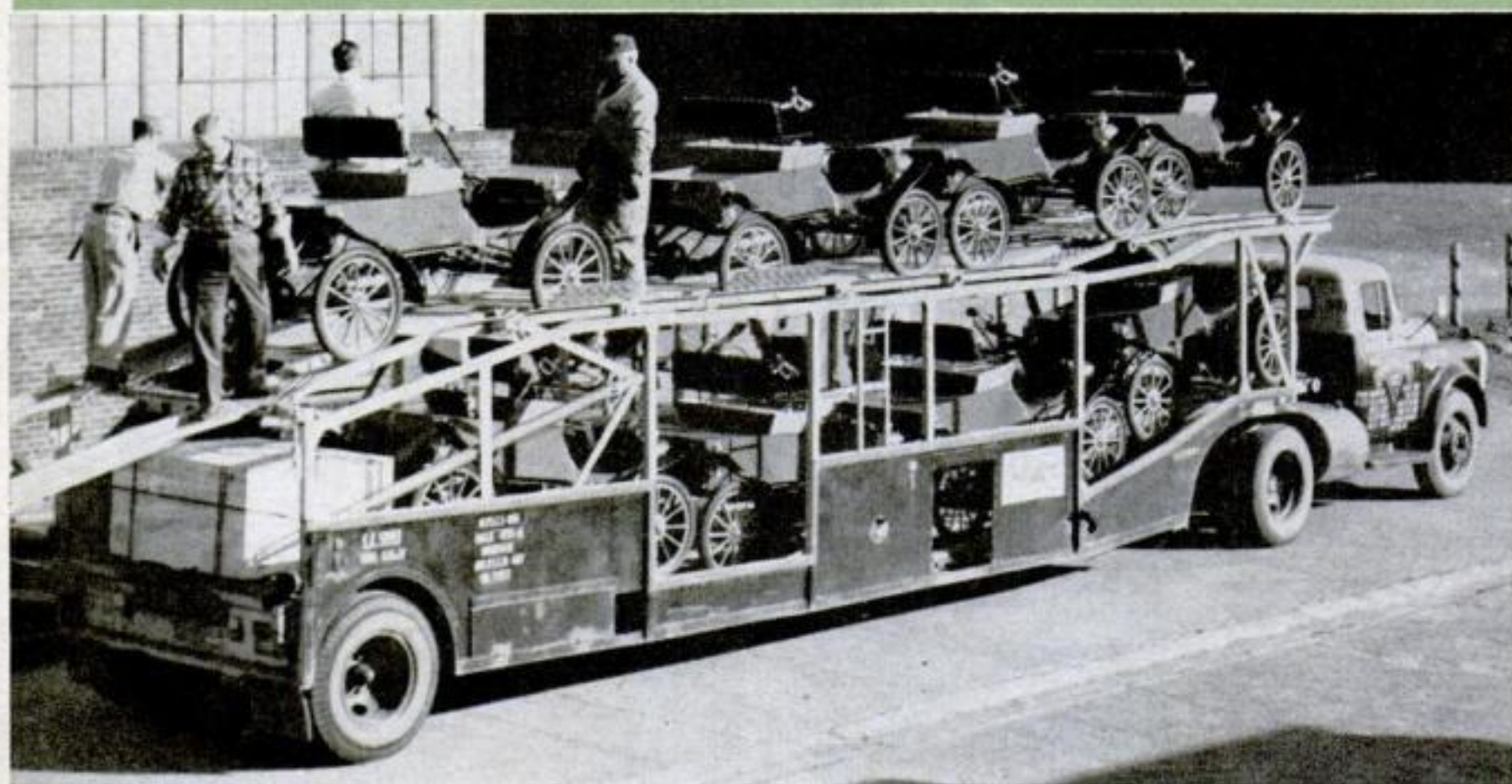
Any two-hp. gas engine can be fitted with centrifugal clutch.



The easy way to own an "antique": Buy one of these



NEW-OLD-CAR PRICES begin at \$1,100 for the do-it-yourself Surrey kit shown at left. The ready-to-run Surrey above costs \$1,295. Either can be ordered from Dyer Products Co., 514 Second St., S.W., Canton 1, Ohio. The car features an eight-hp. engine, electric starter, all-steel body, two-wheel brakes and sealed-beam headlights. Eight Surreys, and a kit, loaded on a modern carrier truck (below) make an unusual sight.



spanking-new ancients now being manufactured again



MERRY OLDS (left) is an authentic reproduction of the 1901 Olds. Priced at \$1,495, it's sold by Old Time Autos, 1270 Avenue of the Americas, NYC 20. It has a four-hp. engine, lights, brakes, wood body.

ROLLSMOBILE (right), a $\frac{3}{4}$ -scale reproduction of 1901 Olds, has a three-hp. engine. Starts Mfg. Co., Fort Lauderdale, Fla., will fly one anywhere in the U. S. for \$1,195. All cars shown on these pages have a top speed of 30 to 35 m.p.h.



Tips on Building Old Cars

BRAKES present the most difficult problem—new-old cars with jury-rigged two-wheel brakes are refused a license in many states. Whether you build or buy your car, better check licensing requirements with your motor vehicle bureau. Otherwise you might end up with a car that can be driven only in parades or on private property. Crosley brake drums or Chrysler drive-shaft parking brakes often can be adapted to old-car rear wheels.

Bicycle wheels are okay for a light car, but sulky wheels—the kind you see at trotting races—are sturdier.

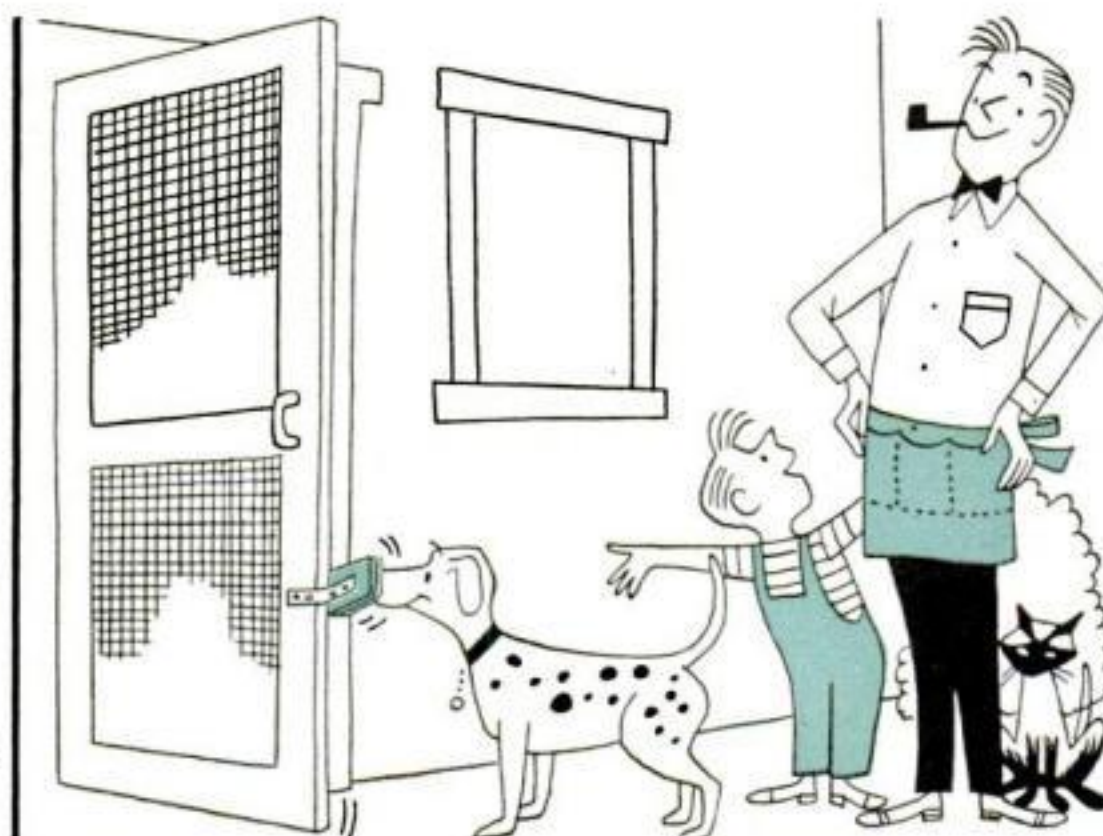
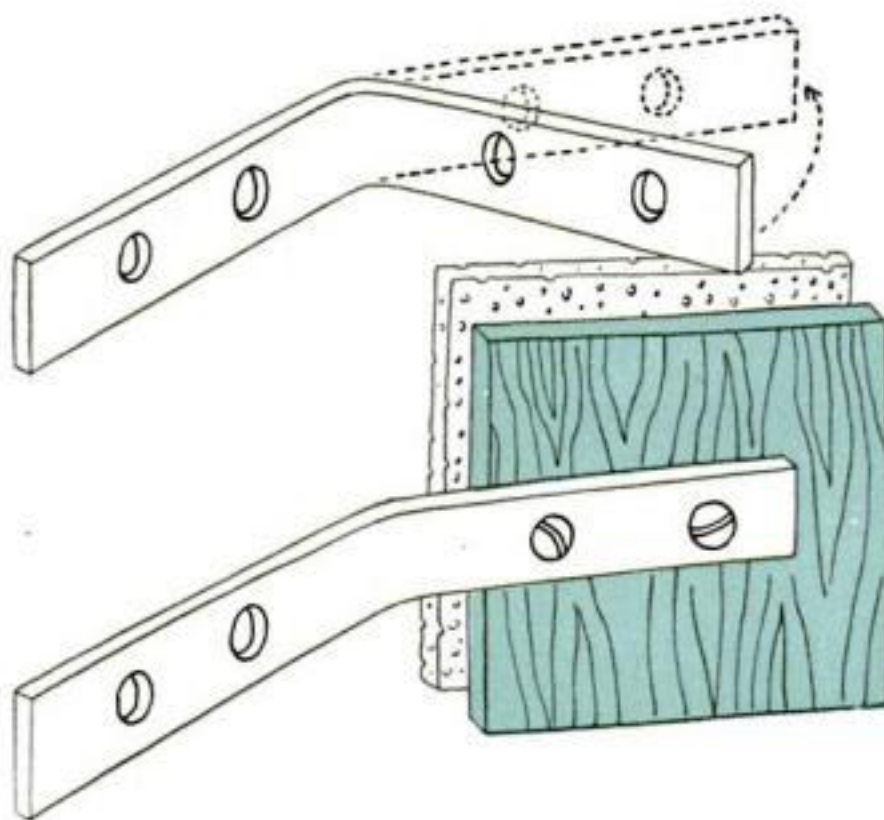
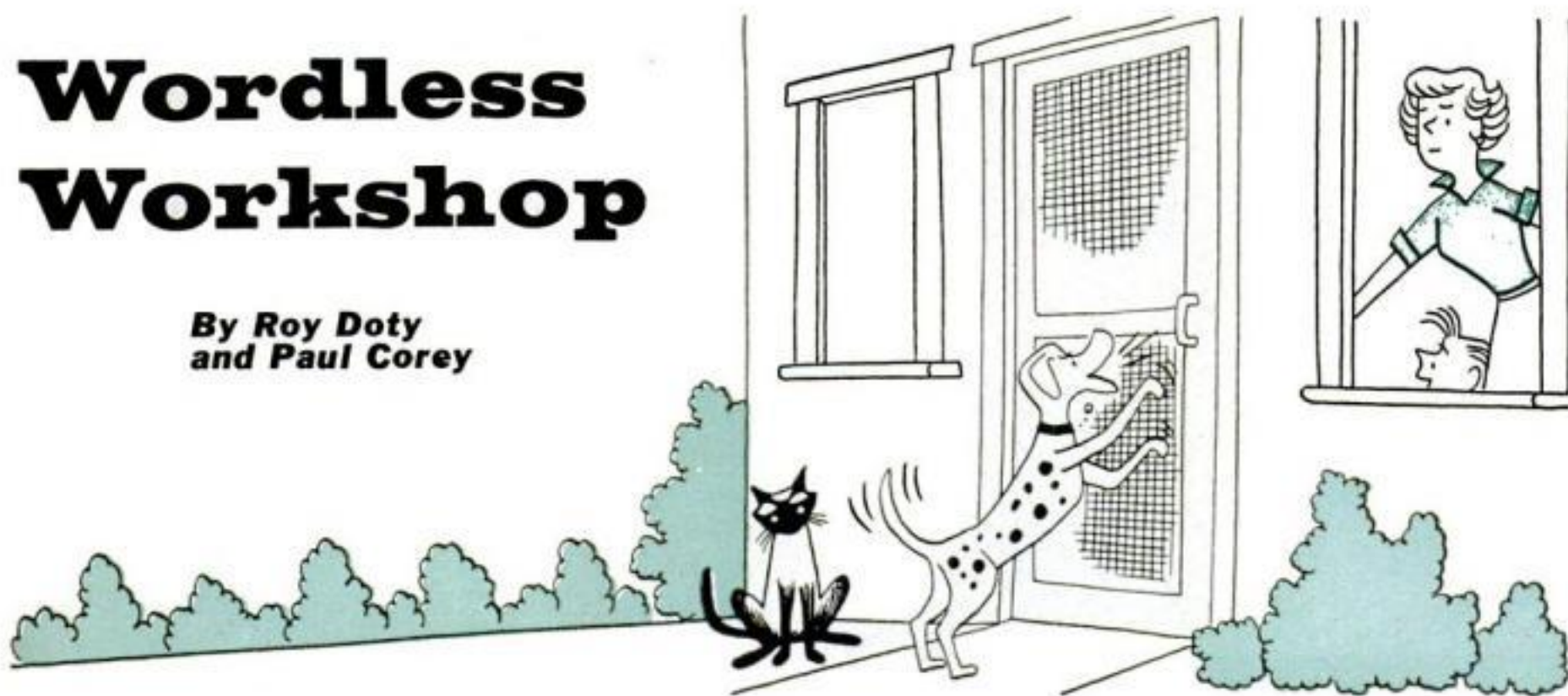
Your transmission and clutch can be as simple as a one-speed drive set in motion by tightening an idler pulley on a loose, slipping V belt.

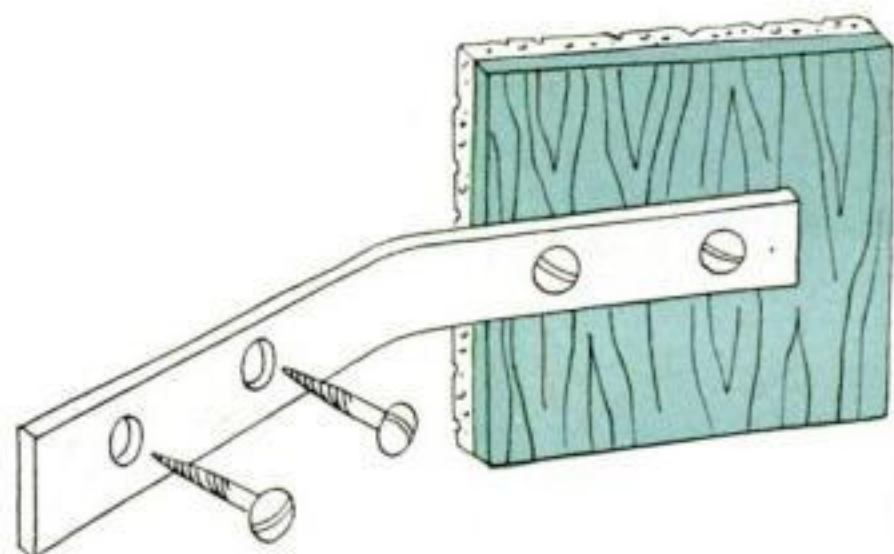
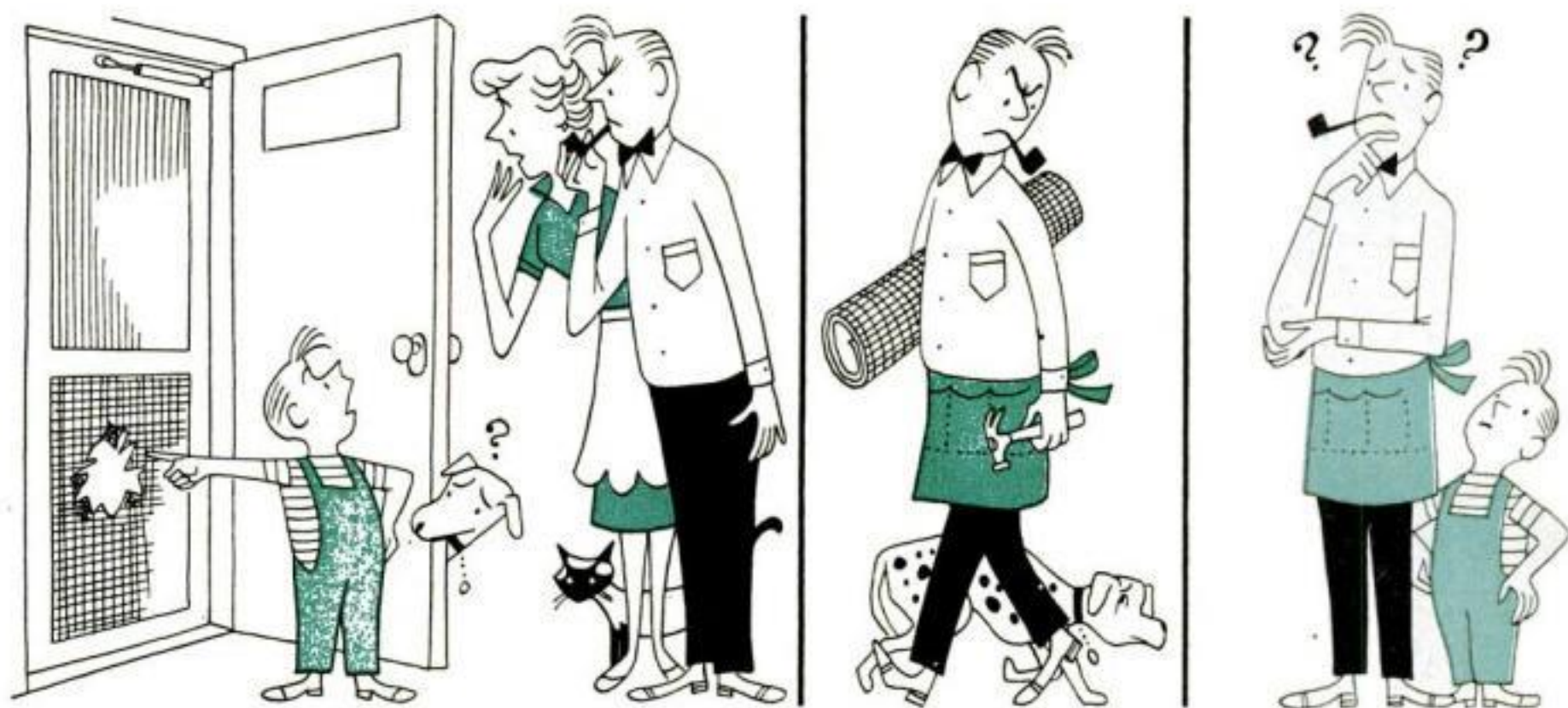
Realistic and effective headlights can be made by installing sealed beams—the type used in campers' lanterns—in old railroad lanterns. You might fabricate antique headlamps from metal lamp bases, light-fixture parts or tin cans.

One final caution: Your old car may have a full-throttle speed of 35 m.p.h., probably less, so even if you get it licensed, stick to the side roads—you'll be a nuisance on the highway. **END**

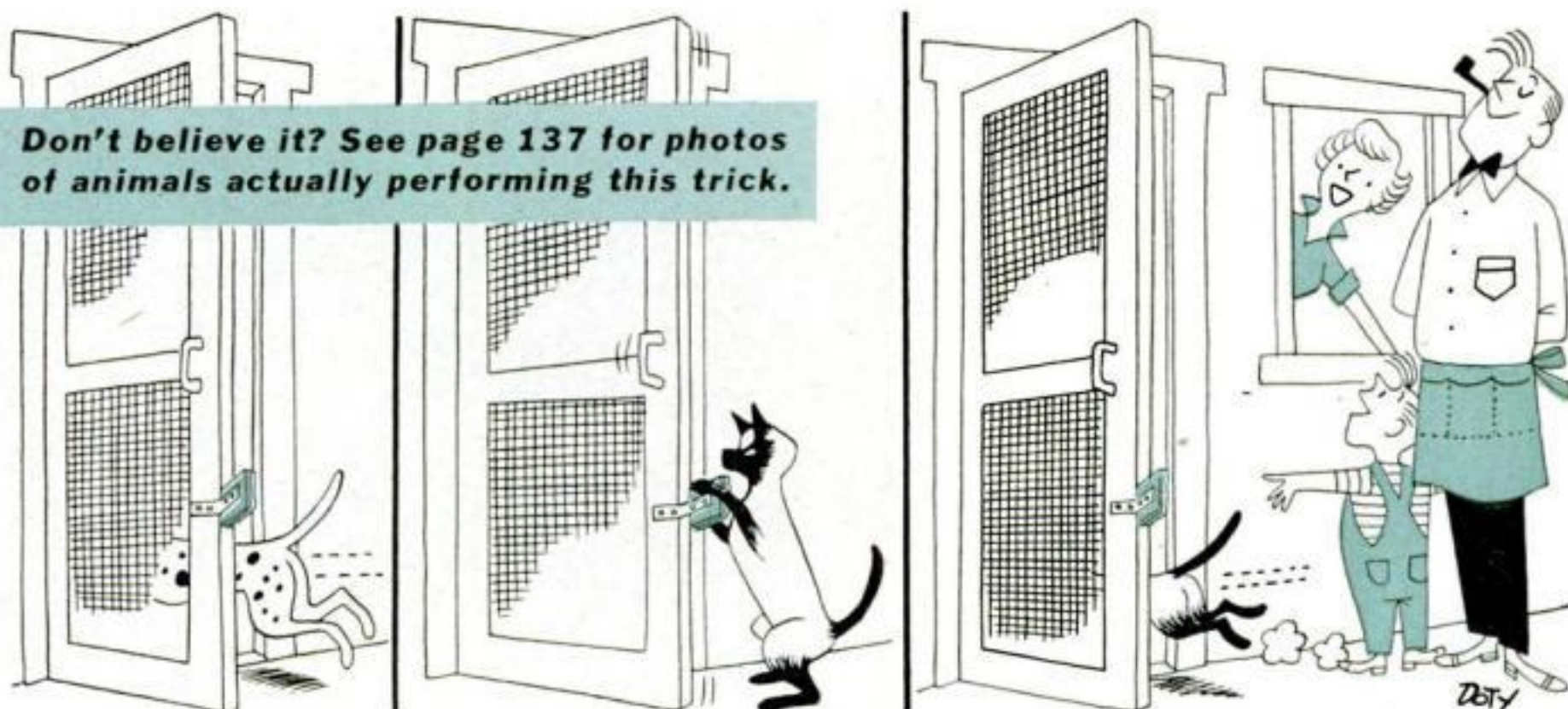
Wordless Workshop

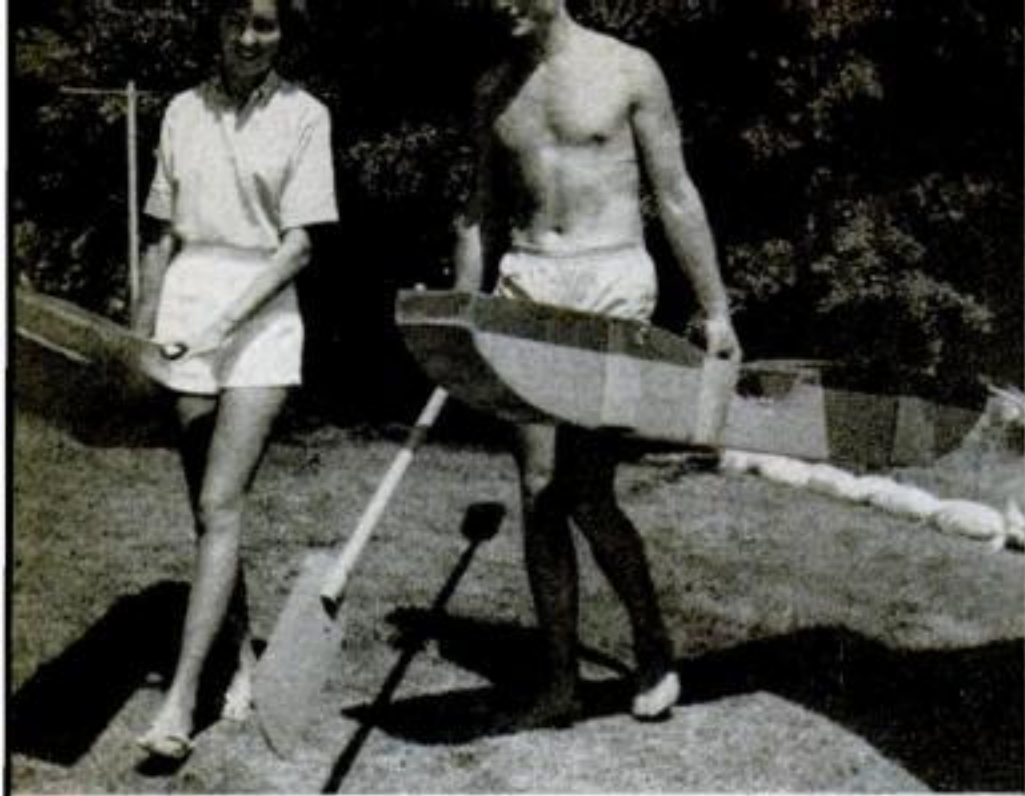
By Roy Doty
and Paul Corey





Don't believe it? See page 137 for photos of animals actually performing this trick.





OFF FOR A WATER STROLL, Mr. and Mrs. Conover carry Joe's 6'-long "gunboats." Weight—15 pounds apiece—is no problem in water since you slide the pontoons, do not lift them.



WHOA, BOY! Putting full weight on one float will sink it, as Joe shows. Idea is to keep weight on both feet. The paddle helps you balance, should be twice as long as you are tall.

WALKING BEATS ROWING and saves cost of a second boat when you have to reach a mooring like this. Two-thirds submerged, floats are not jostled by waves, which pass right over.



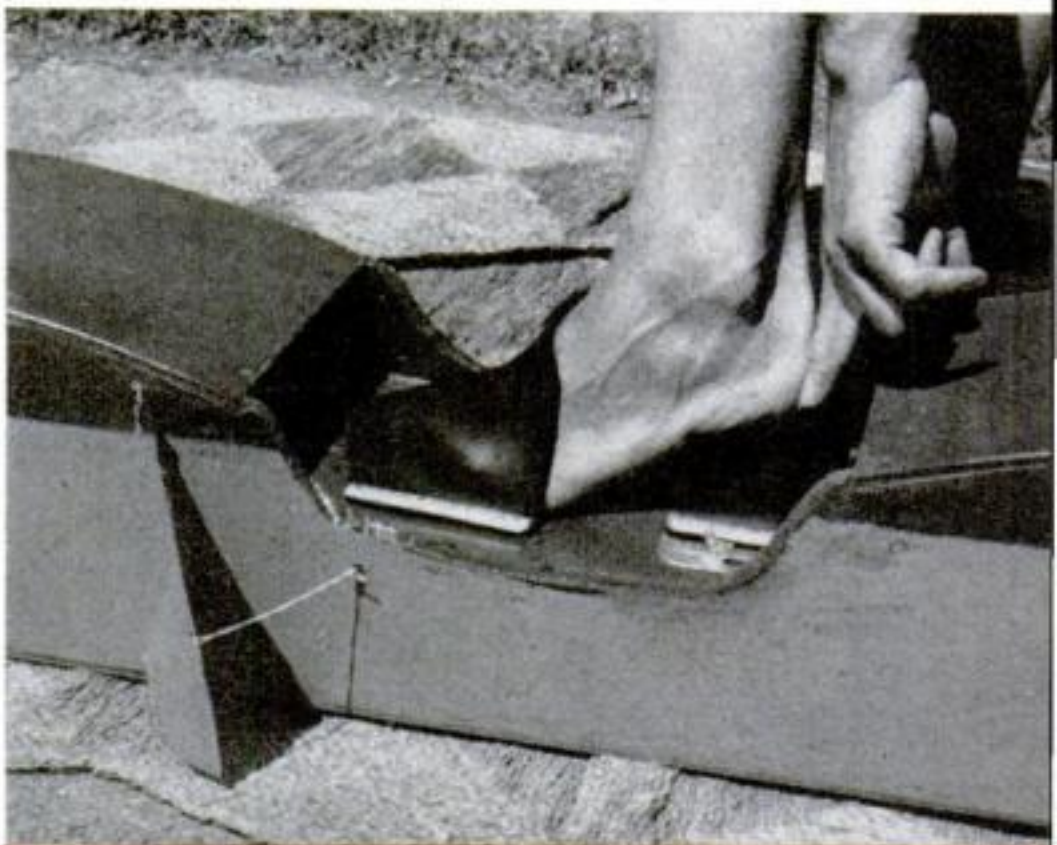
Shod with plywood pontoons, here—believe it or not—is

How You Can Walk on Water

JOE CONOVER of Seattle walks on water on a pair of plywood pontoons. Easy to make, they're essentially long, skinny boxes with regular water-ski bindings attached at the middle. Joe calked the seams, but if they leak, water can be drained out of holes plugged with corks.

Conover's "shoes," built for husky riders, are 6' long and hold 300 lb. For light persons, they should be made smaller or weighted to ride about two-thirds submerged for best stability. Joe's trick is to let water in the drain holes as ballast. By adjusting the amount, he trims the floats to perfect balance.

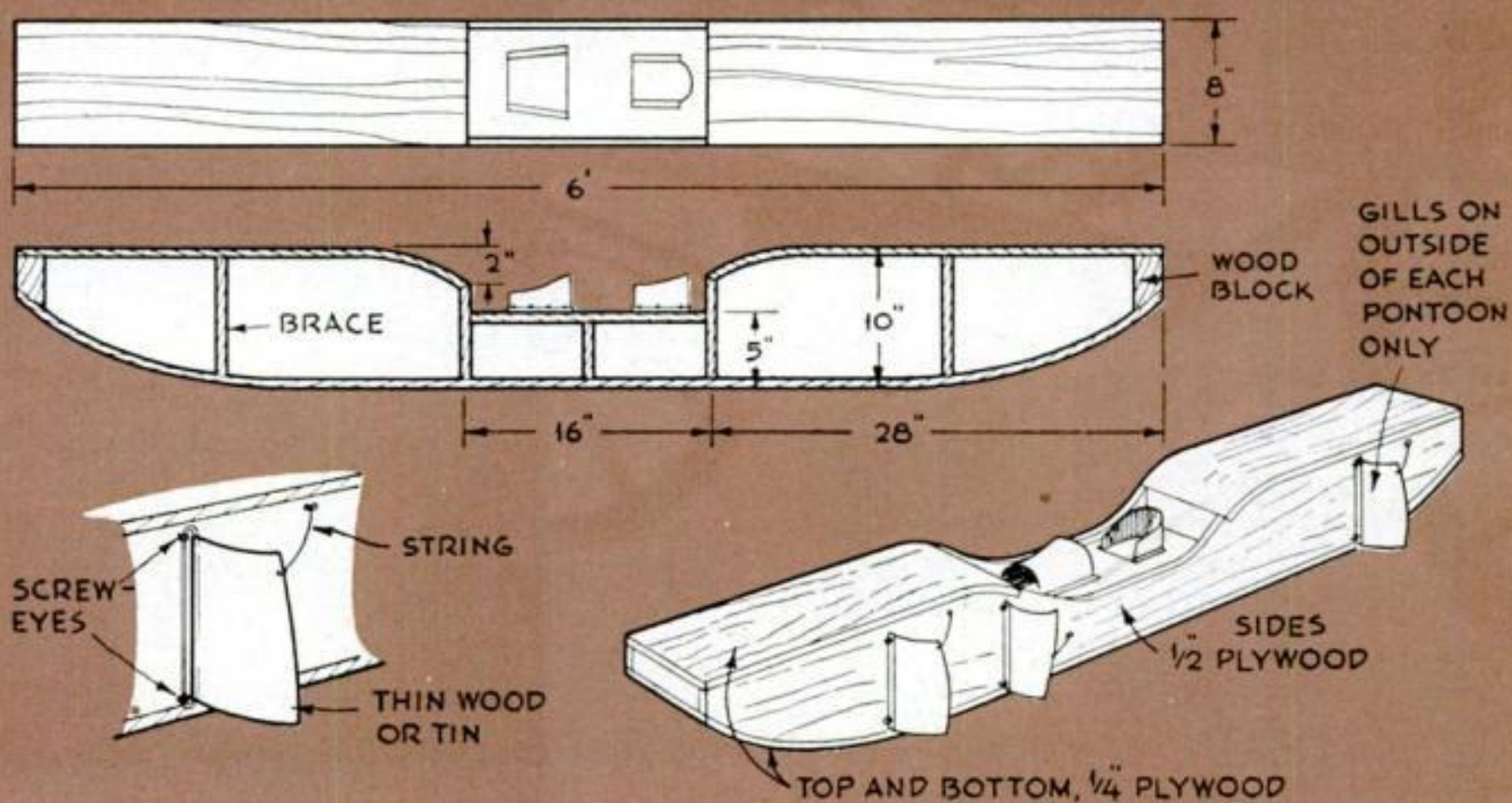
Hinged "gills" at the sides flip outward to help prevent backsliding. With a double-ender paddle, he can hit three m.p.h.—fast walking on either land or sea.



WATER-SKI BINDINGS, available at sport shops, mount on recessed platform to keep feet low for stability. "Gill" at side can be wood or tin-can stock, held by string.

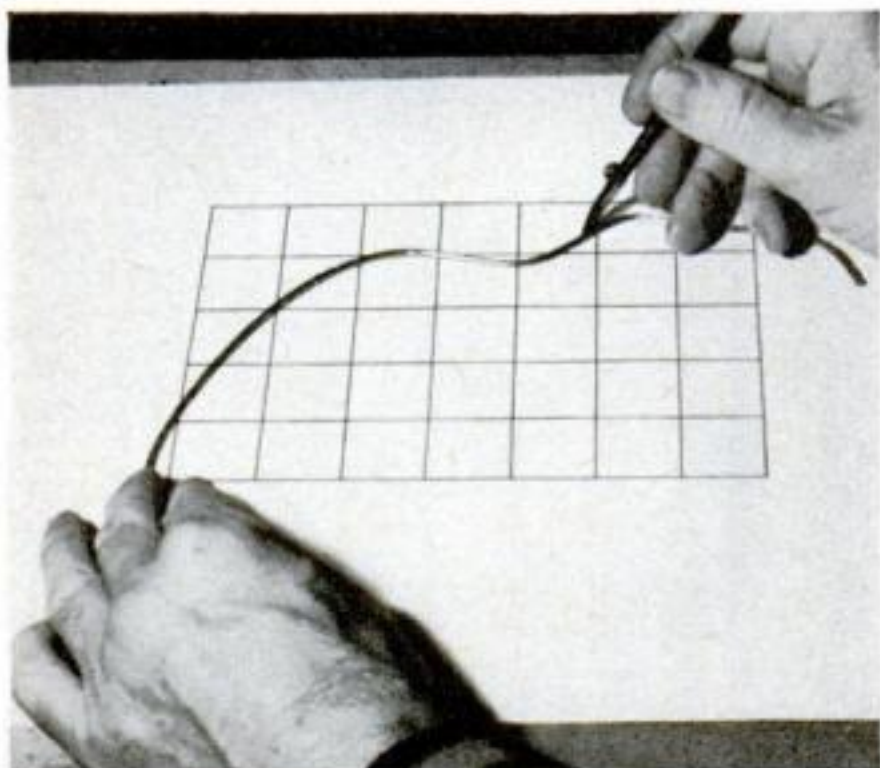


Simple box construction makes "water shoes" easy to build



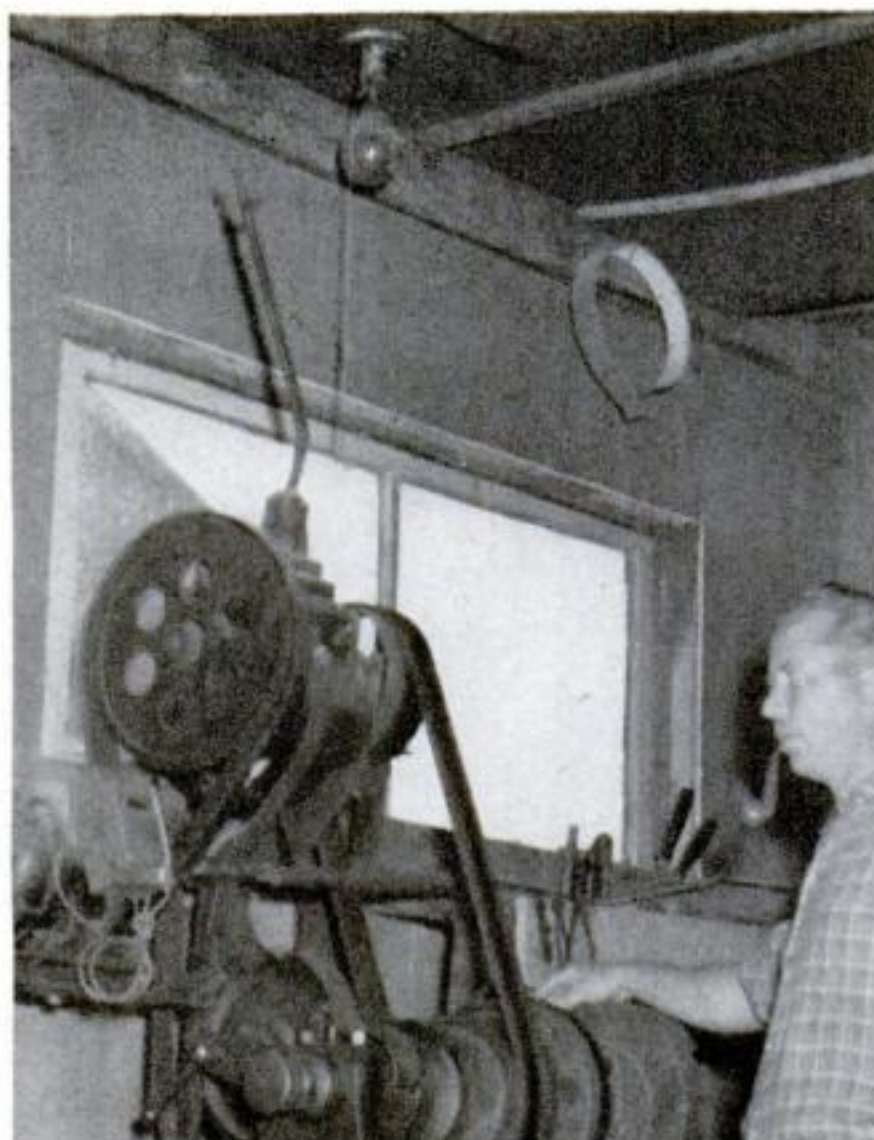
Short Cuts and Tips

FROM PS READERS



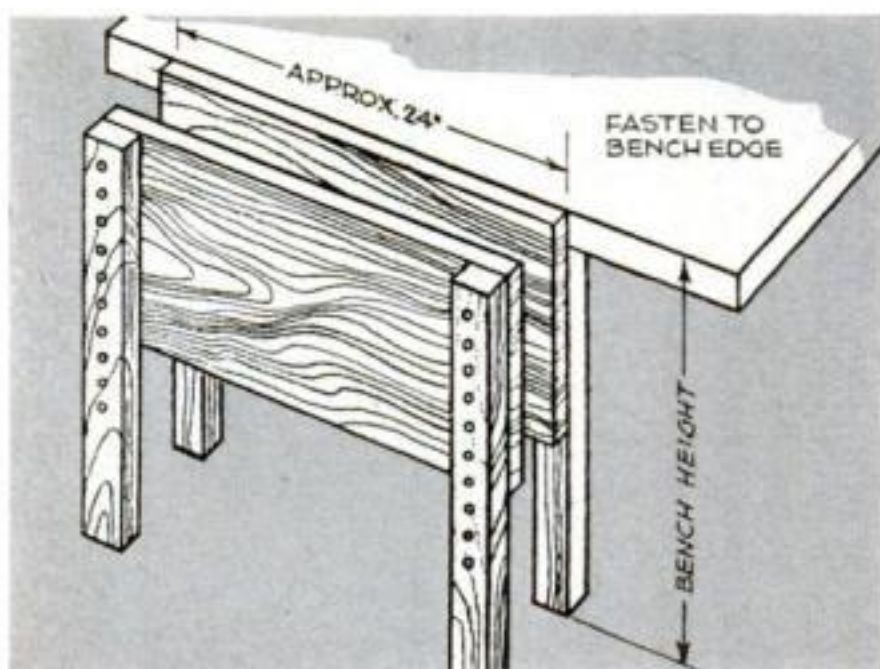
Irregular Curves on Paper

AN EASY way to put odd-shaped curves on paper is with a length of solder wire as a guide. Bend the wire to the desired contour. Then all you need do is follow the curve with a pencil or pen.—*T. C. Van Alstyne, Don Mills, Ont.*



Lathe Without Line Shaft

ONE machine-shop owner of my acquaintance operates his heavy-duty lathe without a line shaft. Instead, he installed an automobile transmission with which he changes lathe speed or reverses rotation.—*John King, Cleveland.*

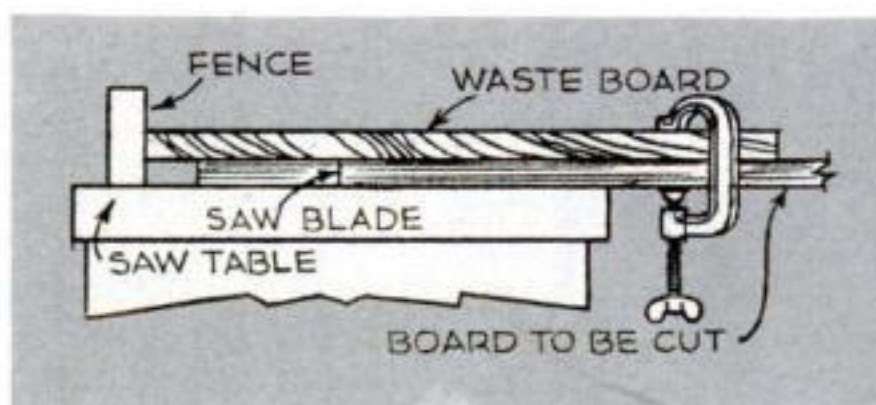


How to Make a Wood Vise

HERE is a woodworking vise that will clamp anything from a small piece to a table top. Dowels are inserted in suitable holes to support the lower edge of the workpiece, and the vise legs are then held near the top with large C clamps.

For table tops and other pieces of large area, support the edge with blocks laid on the floor and clamp about midway.—*John H. Lynch, Pittsfield, Mass.*

▶▶▶ You can restore a knot in a board by gluing it in with shellac. Dip it in undiluted shellac to hold it in place and also to seal in the resin.



Using Fence for Long Boards

WHEN work overhangs the saw table, you can still use the fence for finish, miter and dado cuts near the edge. Adjust the blade so it just cuts through the work. Then set the fence on the left side, nail or clamp a waste board on top of the work and guide its left edge against the fence. The board should be long enough to extend from the fence beyond the edge of the table.—*Joseph Braff, Yonkers, N.Y.*

A Door That Pets Can Open

WHEN animals want to enter the home of Paul Corey in Sonoma, Cal., they walk right up and open the door like people.

The answer is a special "knob" mounted about a foot from the door bottom. How Mr. Corey made it is shown on page 132 in this month's "Wordless Workshop."

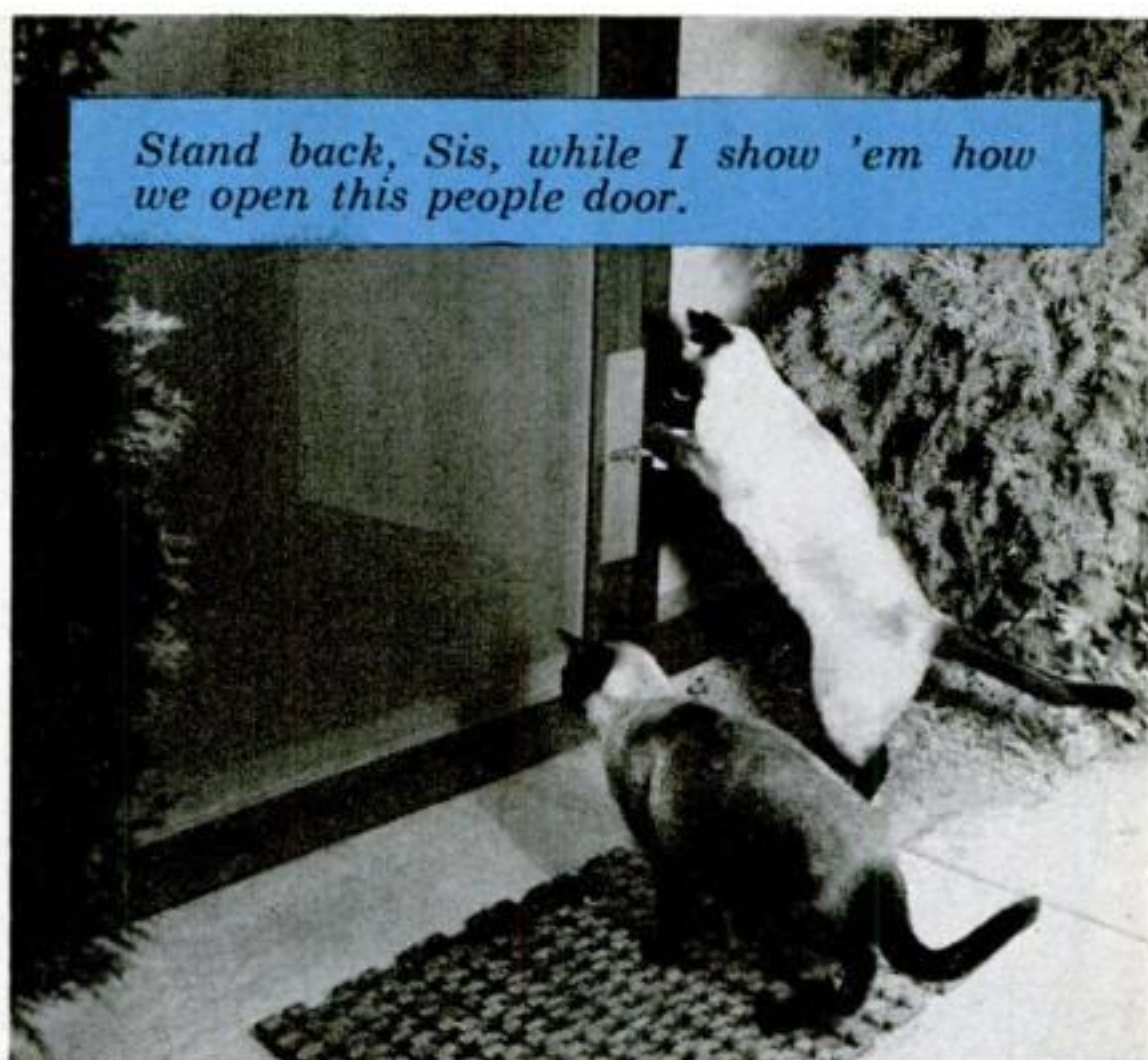
The knob was originally devised for Gorgon the dog—"short for Gorgonzola," says his owner, "because he looked like blue cheese and smelled when he strayed in one day." Gorgon got a bath, but both name and dog stuck.

No sooner had Gorgon mastered the trick—it took him about three days—when it was quickly adopted by Tang the cat, a 2½-year-old male, and his elder six-year-old sister Topsy.

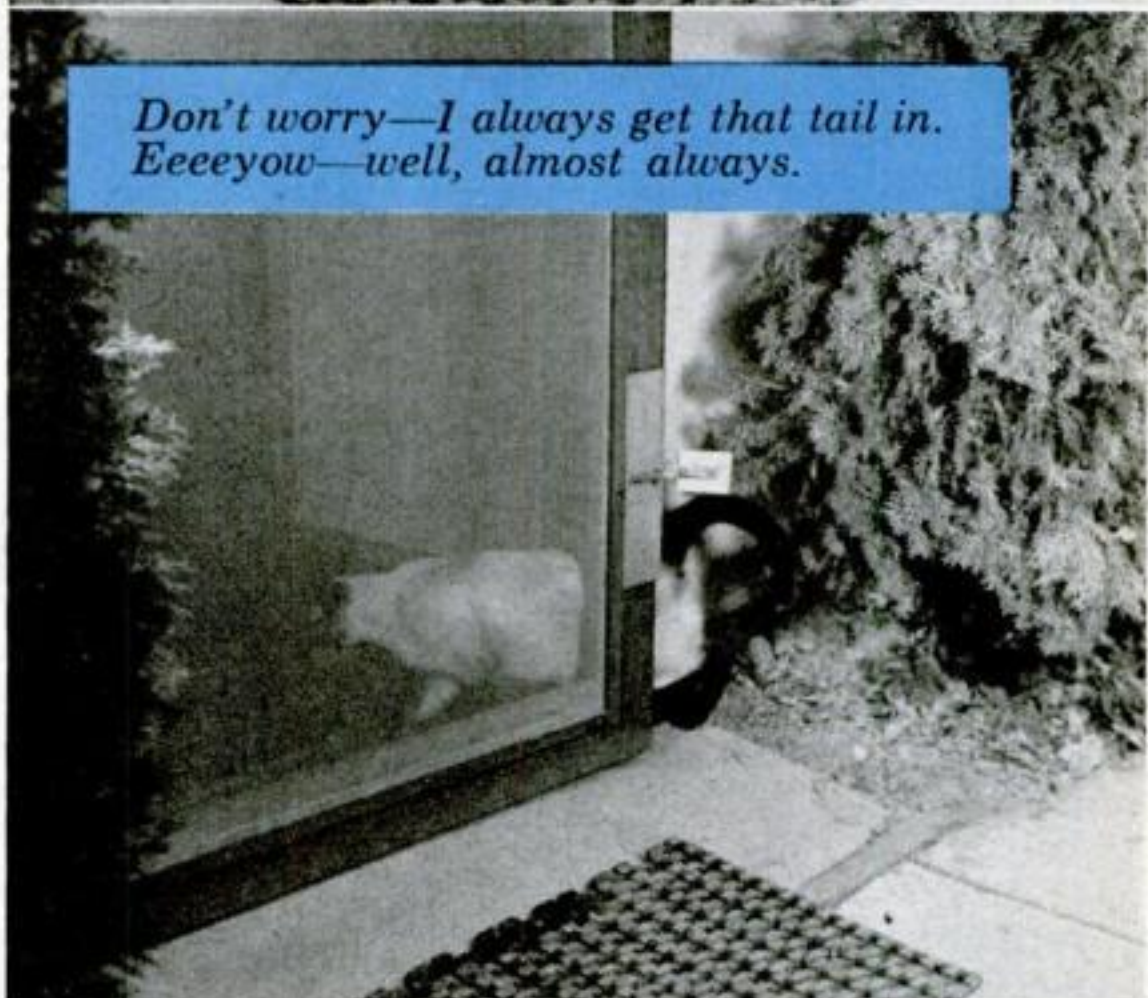
Tang and Topsy, scorning instruction as cats will, just walked up, grabbed the pull in their paws and scooted in. "They like it so much," reports Mr. Corey, "they refuse to come in any other way, even though they have their own door."

Tang, the gentleman, will even hold the door for his sister. But if Gorgon gets there first, they let him open it, then streak in before him. "Tried to get a shot of that," says Corey, "but it was just a blur."

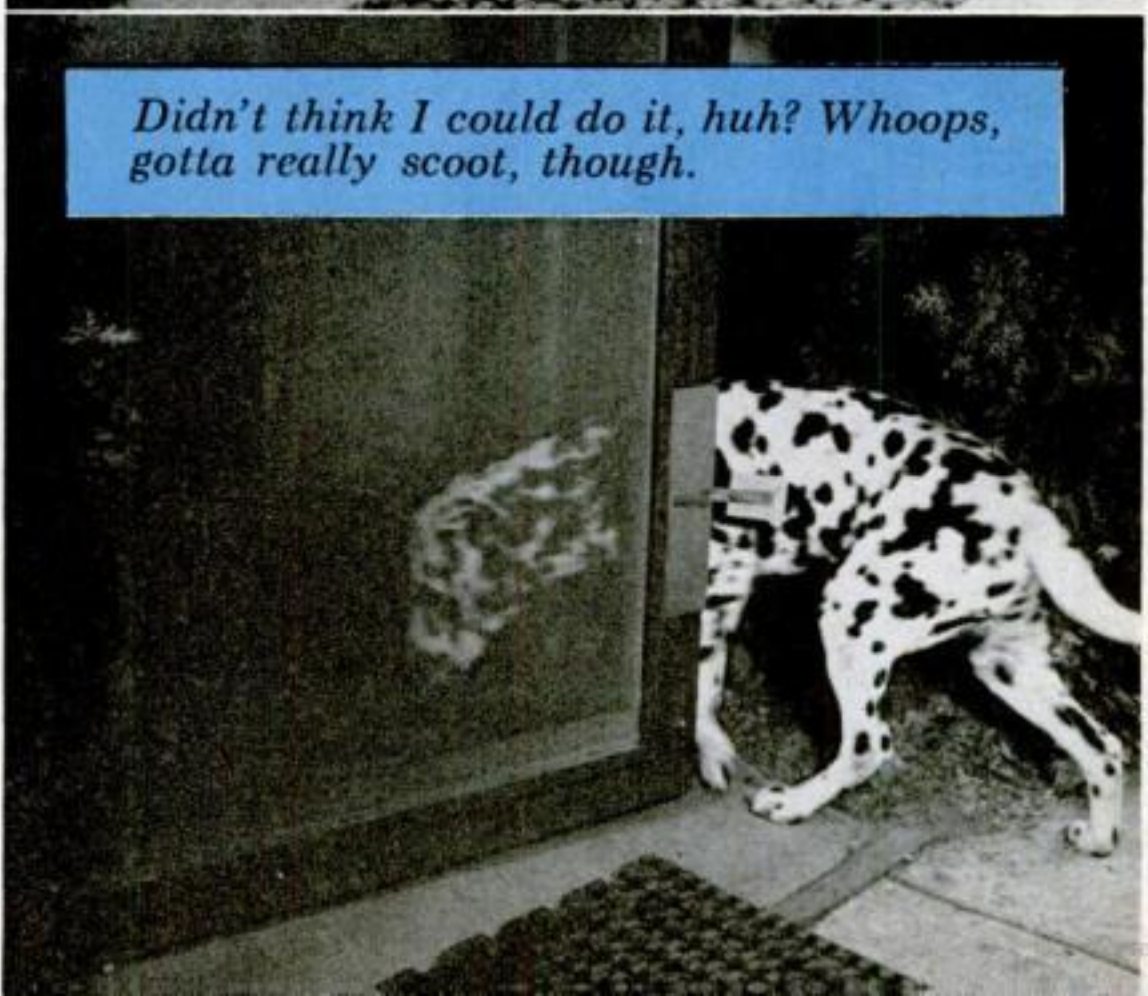
Stand back, Sis, while I show 'em how we open this people door.



Don't worry—I always get that tail in. Eeeeyow—well, almost always.



Didn't think I could do it, huh? Whoops, gotta really scoot, though.





- **COVERED WAGON** (modern style) was fashioned by Al Blake of Farmington, Conn., from an old truck body and four bows. It sleeps two, cost practically nothing.

*To stretch your travel dollars
this summer, check these—*



Unusual Ways of + Vacationing on

- **SPLIT-LEVEL STATION WAGON** gives the Igor Lobanovs of Phoenix a traveling crib without sacrificing cargo space.



- **UPPER BERTH** Hinged roof rack opens at night for an extra bunk for Joe Walstad of Niobrara, Nebr.



THERE'S more than one way to cut the high cost of vacation traveling—and here are pictures of novel ideas to prove it.

All of these campers and tourists carry their own "built-in motels"—novel, yet surprisingly simple.

The Paul Priggs of Pomona, Cal., scavenged an old auto body for \$20, spent another \$25 to weld on wheels and a hitch bar, and came out with a second "car" to haul beds and baggage. Ed Lucas out in Washington solved the cost problem with an ingenious car-top frame that exactly fits a cheap Army pup tent. And the McFarlands in Cincinnati, who found they were lugging their 16' outboard wherever they went, decided they might just as well live in it, too.

Living in your own motel-on-wheels doesn't mean mortgaging your home to buy a house trailer. Simple box trailers and boat trailers can be outfitted for sleeping with little more than a frame to support a canvas topping, as Al Blake did on the opposite page.

In areas where trailers pose insurance problems or are not permitted on highways, you may do well to consider a car-top rig that leaves you no worries to tow. More car-camping ideas and construction details are shown on the three following pages.—*Sheldon M. Gallagher.*



CAR-TOP TENT keeps the Ed Lucas family of Poulsbo, Wash., high and dry while roaming northern wilds.



CAR TRAILING A CAR Junked auto body (\$20) makes a roomy camper for the Paul Priggs of Pomona, Cal.

Wheels

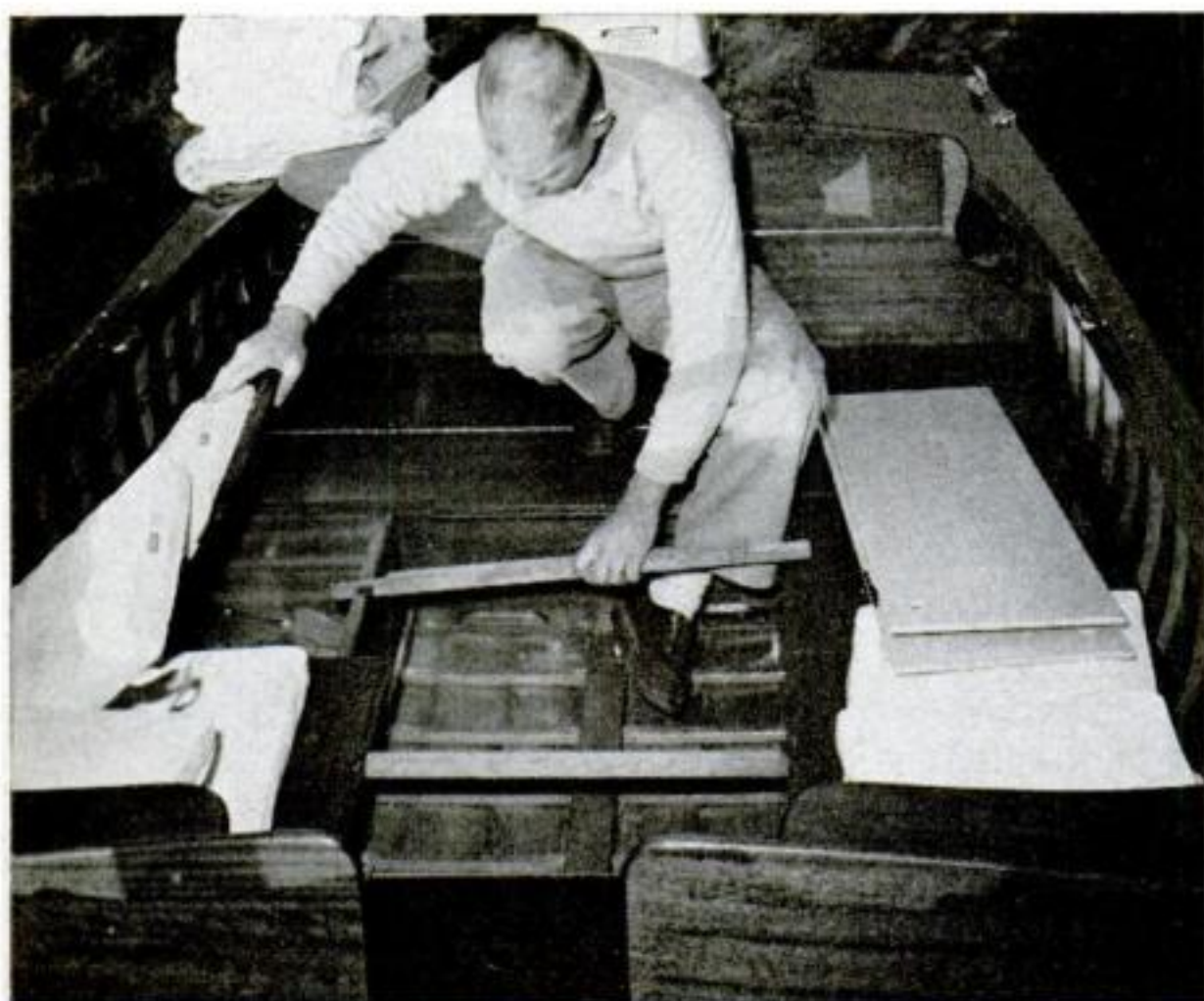
DOUBLE-DUTY BOAT not only provides fun on water, but converts quickly at night to a four-bunk roadside sleeper for the John McFarlands of Cincinnati.



Piggyback shelter stows the whole family on top of the car

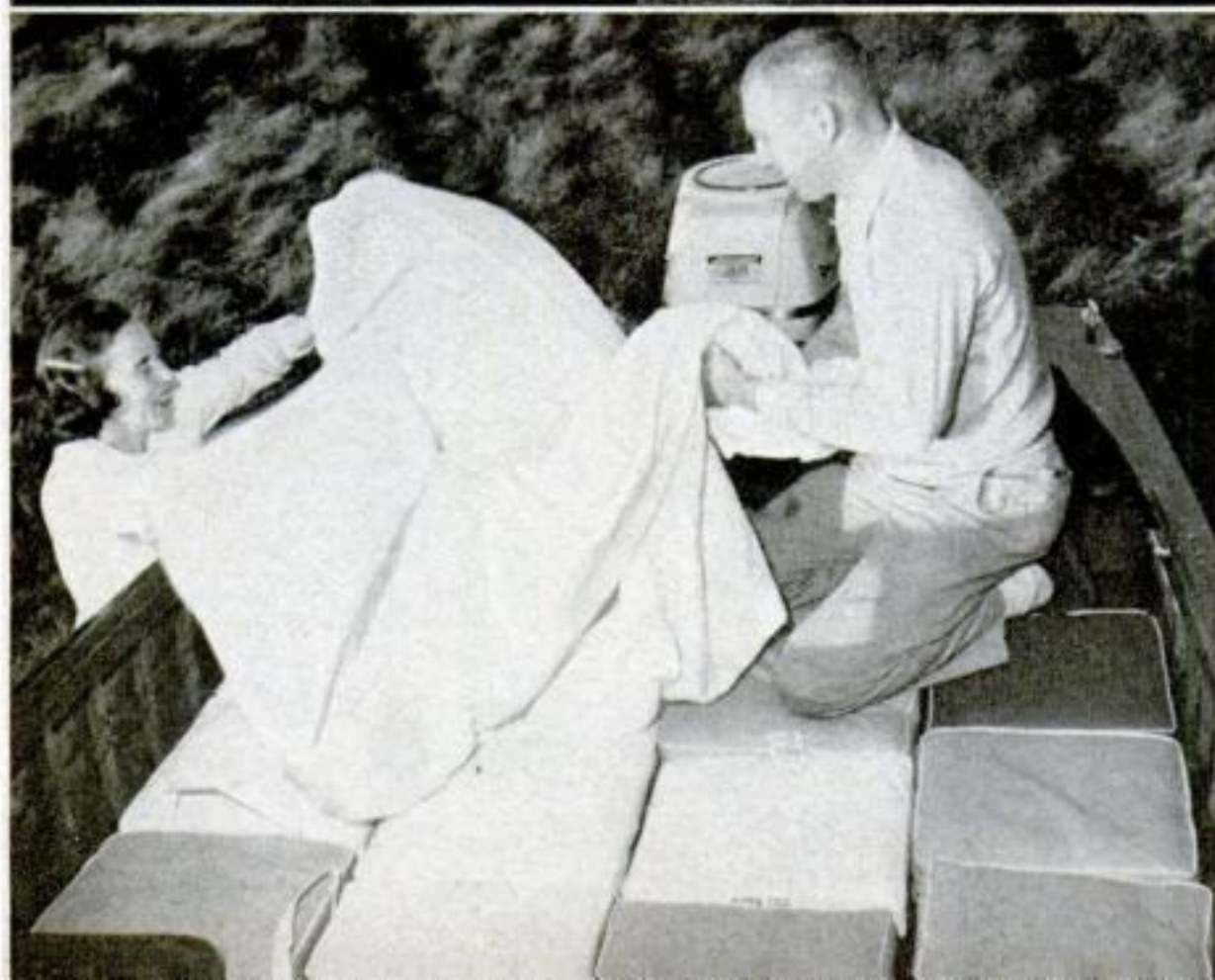
WHEN the family of James Redmond moved to Visalia, Cal., this car-top "hotel" provided overnight shelter for five.

It's made of a wood frame covered with hardboard panels, contoured to fit the roof and rear deck. Car straps that hook under the roof hold the front part on, while suction cups steady the rear. Total cost, including rubber mattresses: \$75.



Boat becomes a bed in this quick roadside change

How the McFarlands convert their trailer-hauled outboard to a bed at night is shown in the pictures at left. The floorboards are first removed and two cross strips are set into notches cut just below the top of the two hinged side seats (upper photo). The floorboards are then put back on top of the cross strips. This raises them flush with the two side seats and provides a spacious platform the full width of the boat. Four rows of seat cushions, as shown in the lower photo, then provide sleeping space for two large and two small McFarlands. For privacy and protection against weather, a canvas enclosure is stretched from the windshield to the stern over a standard collapsible boat-top frame.

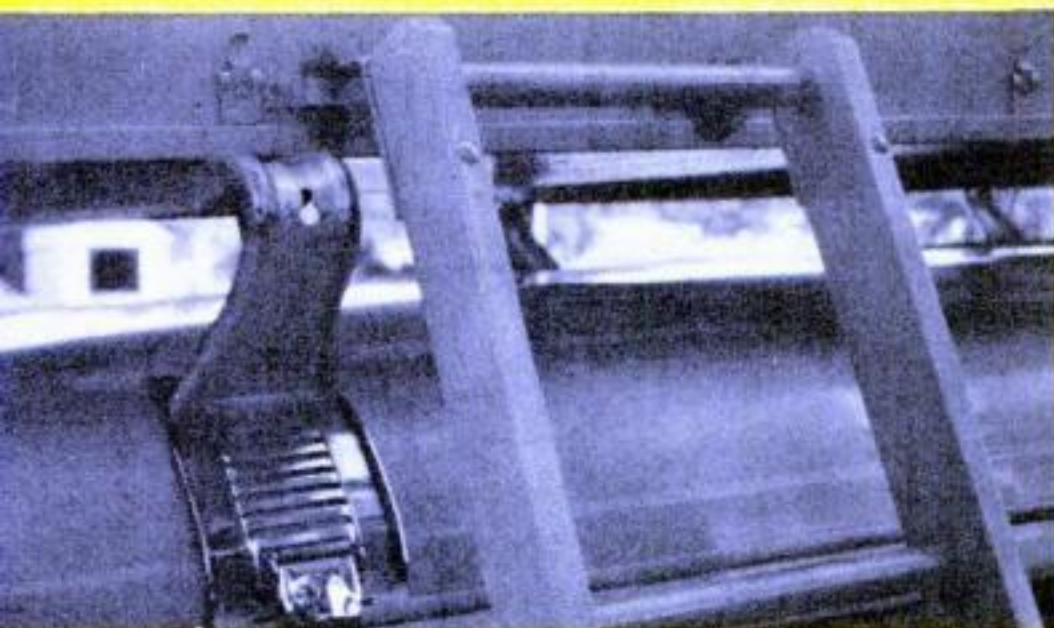


Roof-top rig lugs supplies by day, is a sleeper at night

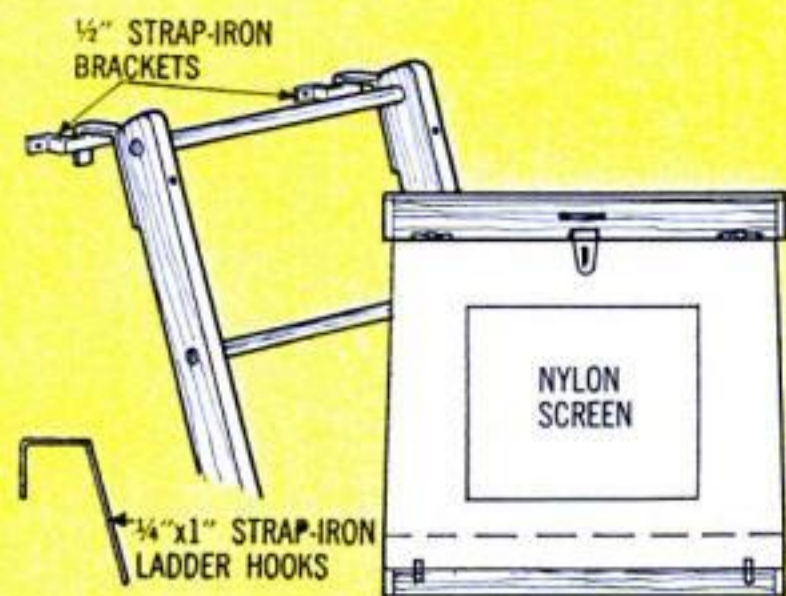
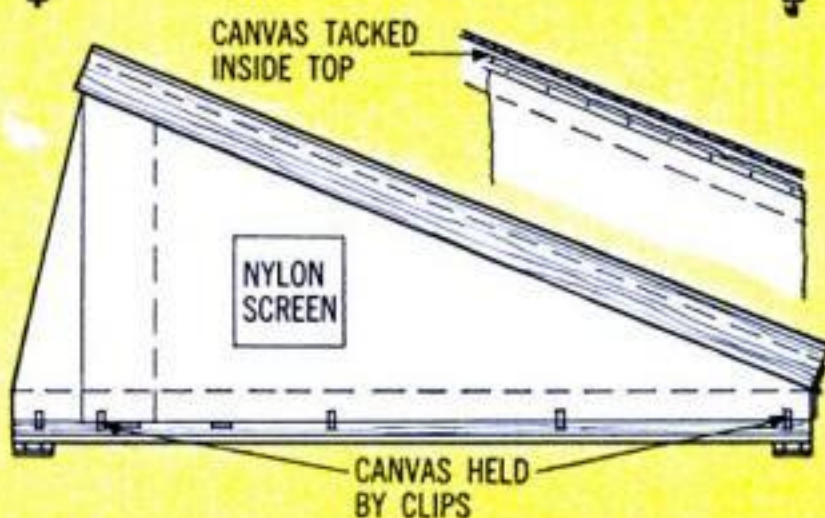
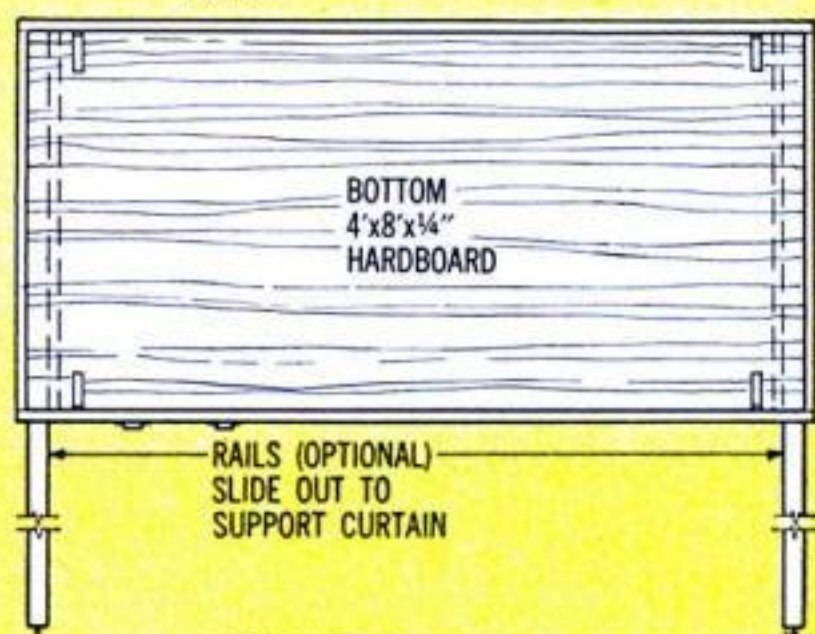
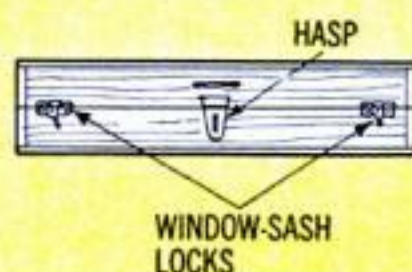
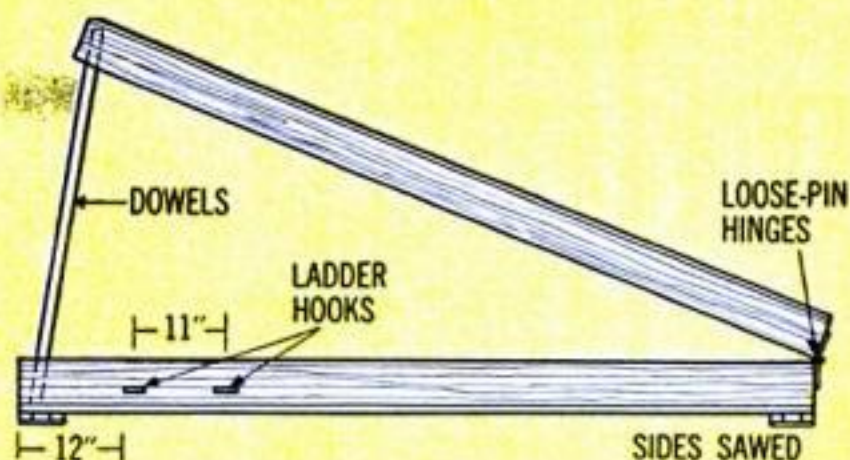
WHEN Joe Walstad calls it a day, he unpacks a spacious roof-top "box," props up the hinged lid and crawls in for a snooze. Sides of the box are one-by-tens slant-sawed down the middle so the two halves provide a rain-tight joint. A triangular-shaped canvas tent tacked to the lid completes his folding sleeper.



TWO DOWELS PROP LID OPEN for sleeping. Loose-pin hinges at the front enable lid to be removed completely for carrying large loads.

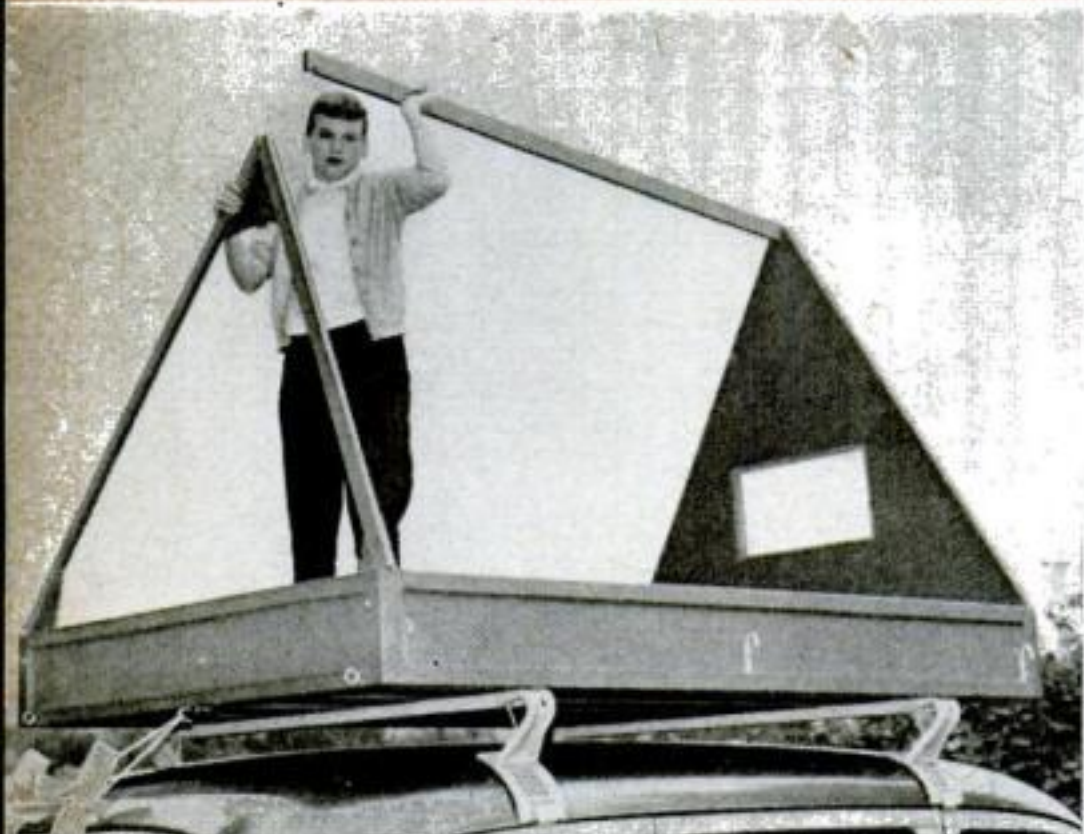


PULLMAN-STYLE LADDER hooks to side of "upper berth" for easy climbing in. Bottom of bunk is bolted to car-top carriers. [Please turn the page.]

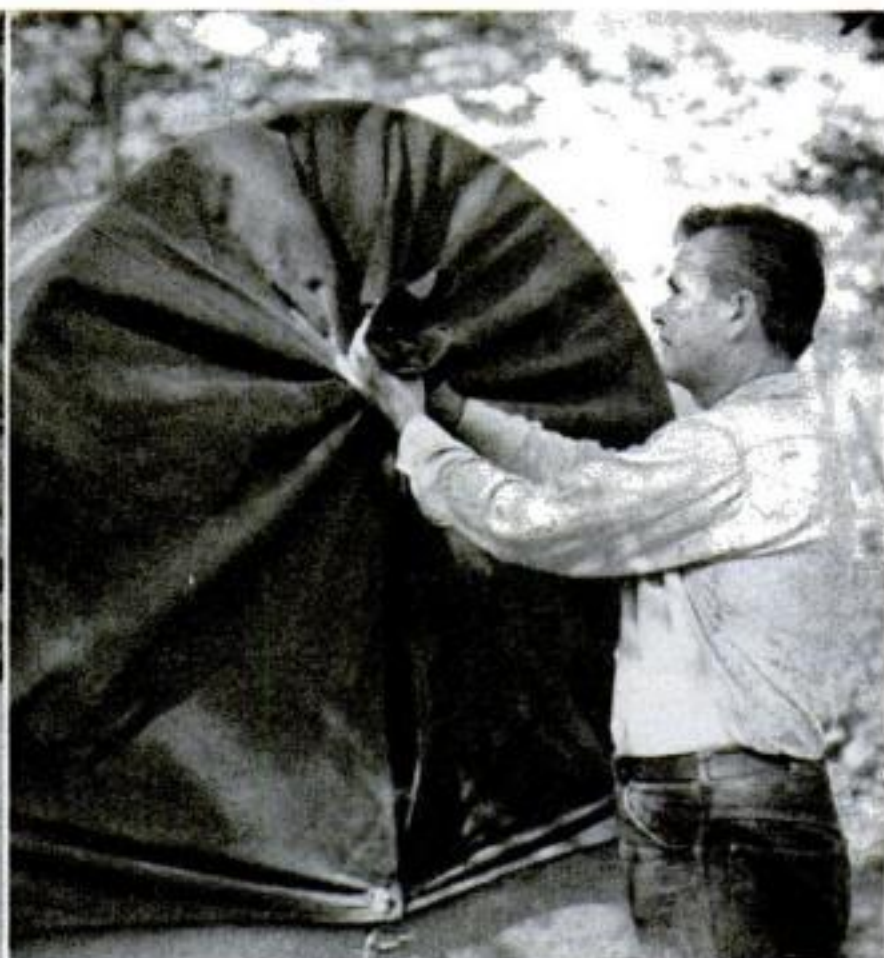


This car-top shelter uses an inexpensive Army tent

TWO wood triangles pop up from this roof-top rig, made by Ed Lucas, to support a standard Army pup tent. The triangles, 48" tall and 54" wide, are braced by a ridgepole notched at the ends to lock into matching notches in the peaks. The 66"-long platform is $\frac{1}{4}$ " plywood braced by side and bottom strips.



Lift-off frame converts utility trailer to a camper



BOWS BENT FROM ELECTRICAL CONDUIT slip into sideboard sockets at each end of this old truck bed that Al Blake uses to haul supplies. Braces welded at top, sides and across ends of the

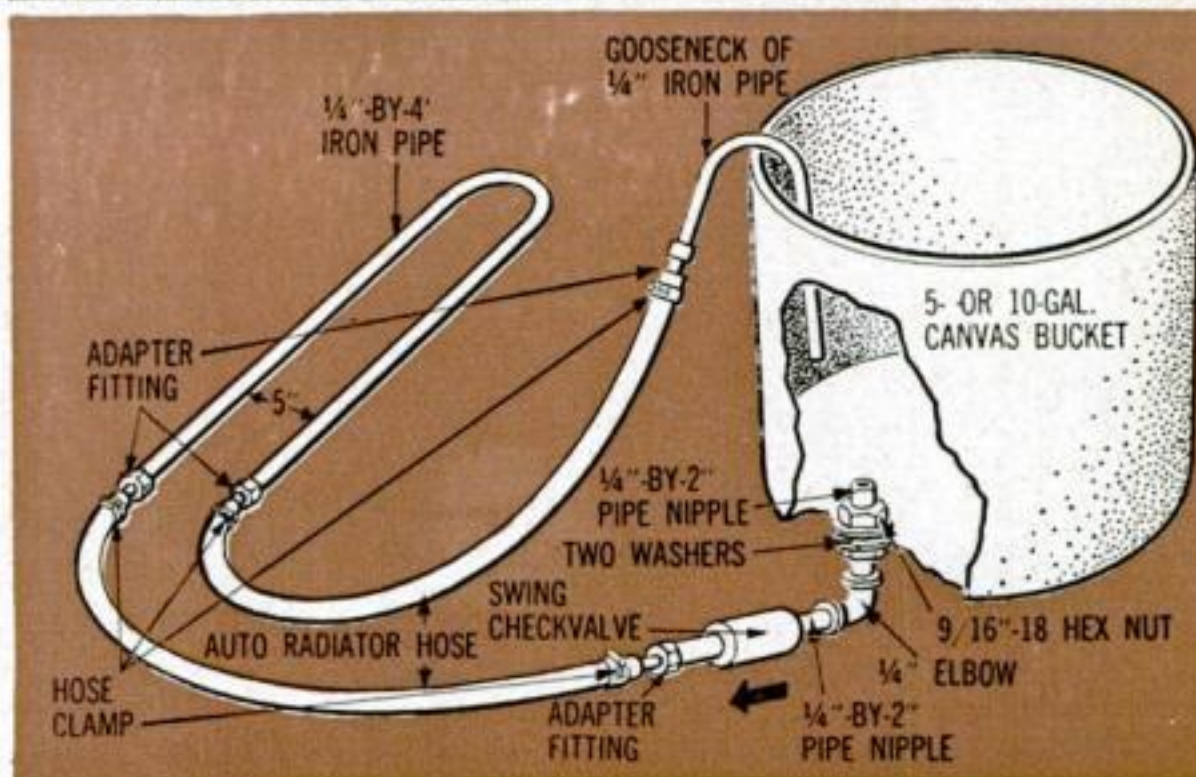
bows form a rigid frame that can be lifted on or off in seconds. A 10'-by-12' canvas tarp tied over the frame and foam-rubber mattresses complete his two-bed "covered wagon." **END**

Heating Water at the Campfire

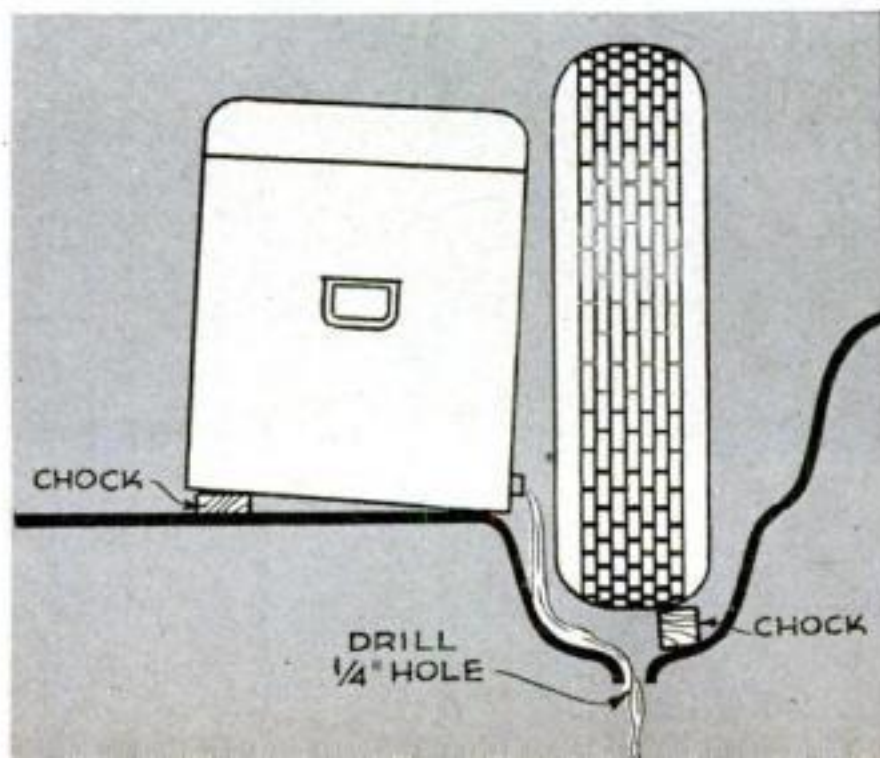
HOT water for cooking and washing is plentiful when Troop 612 of Levittown, N.Y., camps out. Scoutmaster Bob Walkinshaw devised a heater that turns out continuous hot water without being moved and does not interfere with cooking.

It works like this: Cold water runs out of a swing check valve in the bottom of a container, through a rubber hose into a hairpin-shaped length of steel pipe. Inside the pipe, which lies under the fire, the cold water turns to steam and hot water. Steam pushes its way out of the pipe into another rubber hose and then through a gooseneck of metal tubing into the first container—or a second one.

A 10-gallon canvas bucket (about \$1 from army surplus) makes a handy collapsible container. Auto heater hose is fine for connecting up the sections of pipe. For safety, a wire mesh strainer should cover the valve intake on the bottom of the bucket—to keep out glop that might clog the pipe and cause an explosion. —S. Richman, Levittown, N.Y.



A CONTINUOUS WATER HEATER for the campfire uses a bucket, one-way valve, hose and pipe. Cold water from the bucket is warmed in the pipe as it flows through and out by convection.



Self-Draining Car-Trunk Cooler

By CHOCKING one side of a cooler in the trunk of your car so it drains into the tire well, you can keep picnic drinks cold or a fishing trip's catch fresh indefinitely without stopping to drain off the water from the melted ice. If there is no drain hole in your tire well, drill a $\frac{1}{4}$ " hole in it at the lowest point. —Don Howard, Norwood, Ohio.

You can increase your shop savvy
by making these—

2 Sheet-Metal Novelties

Ping-Pong-Ball Caddy

TRIM a piece of 28-gauge galvanized iron to $5\frac{1}{2}$ " by $11\frac{1}{8}$ " overall size. Lay out the design, scribing the cutting and bending lines and locating the hanging hole. Where possible, cut along the outline with tin shears. Use a coping saw with a fine-toothed, metal-cutting blade for the $\frac{3}{4}$ "-radius inside curves. Drill out the hole.

Do the bending with hardwood blocks, as shown in the drawing below. Note that the one around which the metal is formed has one beveled face. This is necessary for a 90-degree bend because the material springs back a bit and must be worked slightly beyond the desired angle.

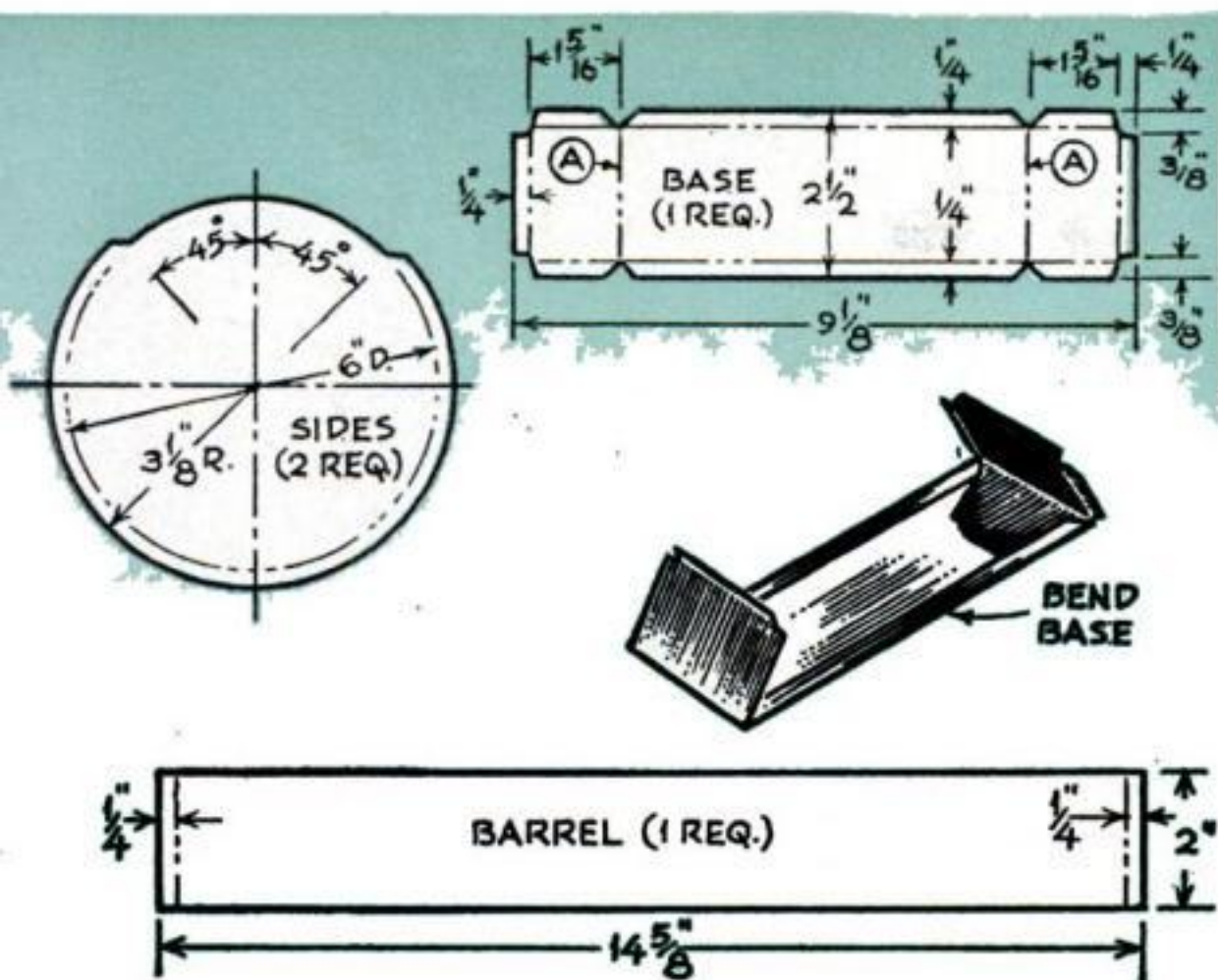
Make the bends in this order: A (full fold), two C's, two D's, B and E (all 90 degrees). Before making the E bend, sandpaper the inner faces of the laps on the base section, also the areas they will contact when they're brought up *outside* the caddy walls. Then apply a thin coat of solder (tinning) to the cleaned surfaces. After bending the base, hold the hot iron against the laps until the solder forms firm "sweated" joints.

Smooth edges with a fine-toothed file and polish with steel wool. If you enamel, start with a coat of aluminum paint.

● The two plans shown here were adapted from a new book: "56 Graded Problems in Elementary Sheet Metal Work," by Algot E. Anderson; McKnight & McKnight, Bloomington, Ill., \$3.80.

HOLD BLOCK being struck at the line of bend—if placed higher it will bow the side of the metal sheet.

THIS FACE OF BLOCK BEVELED



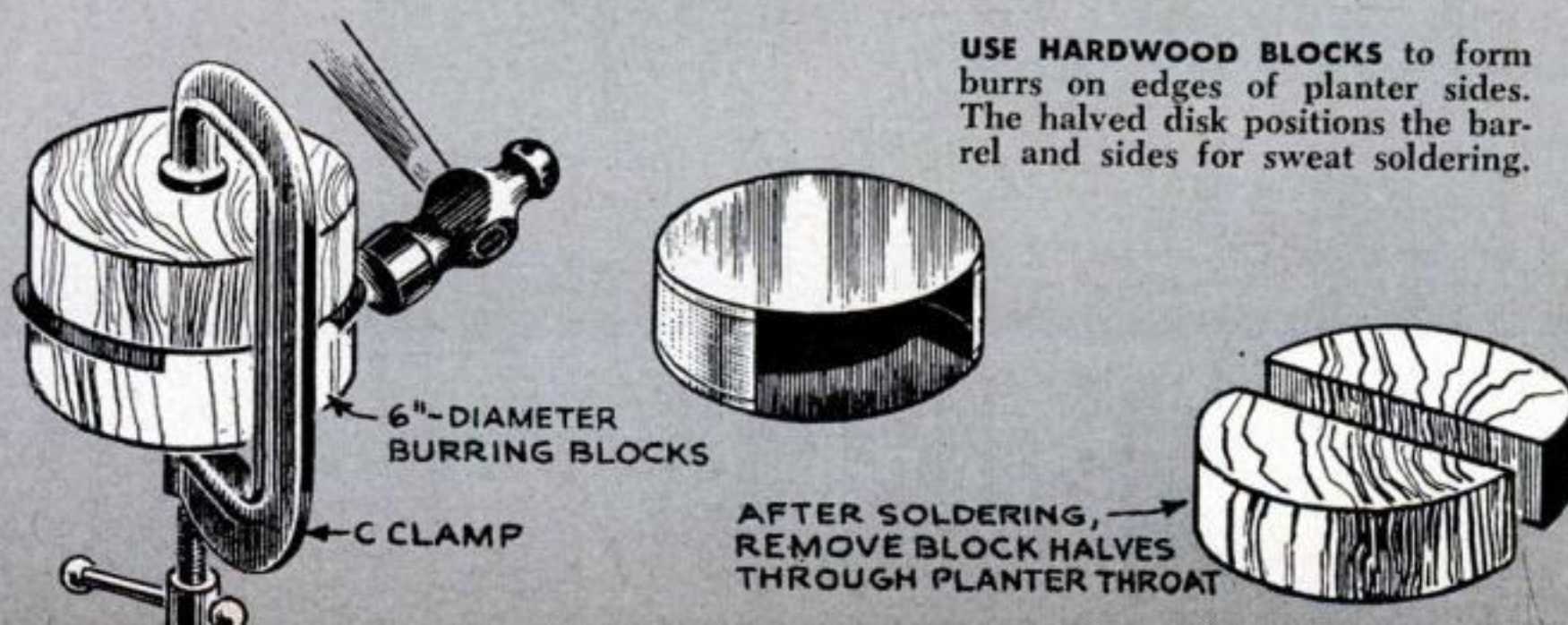
Planter

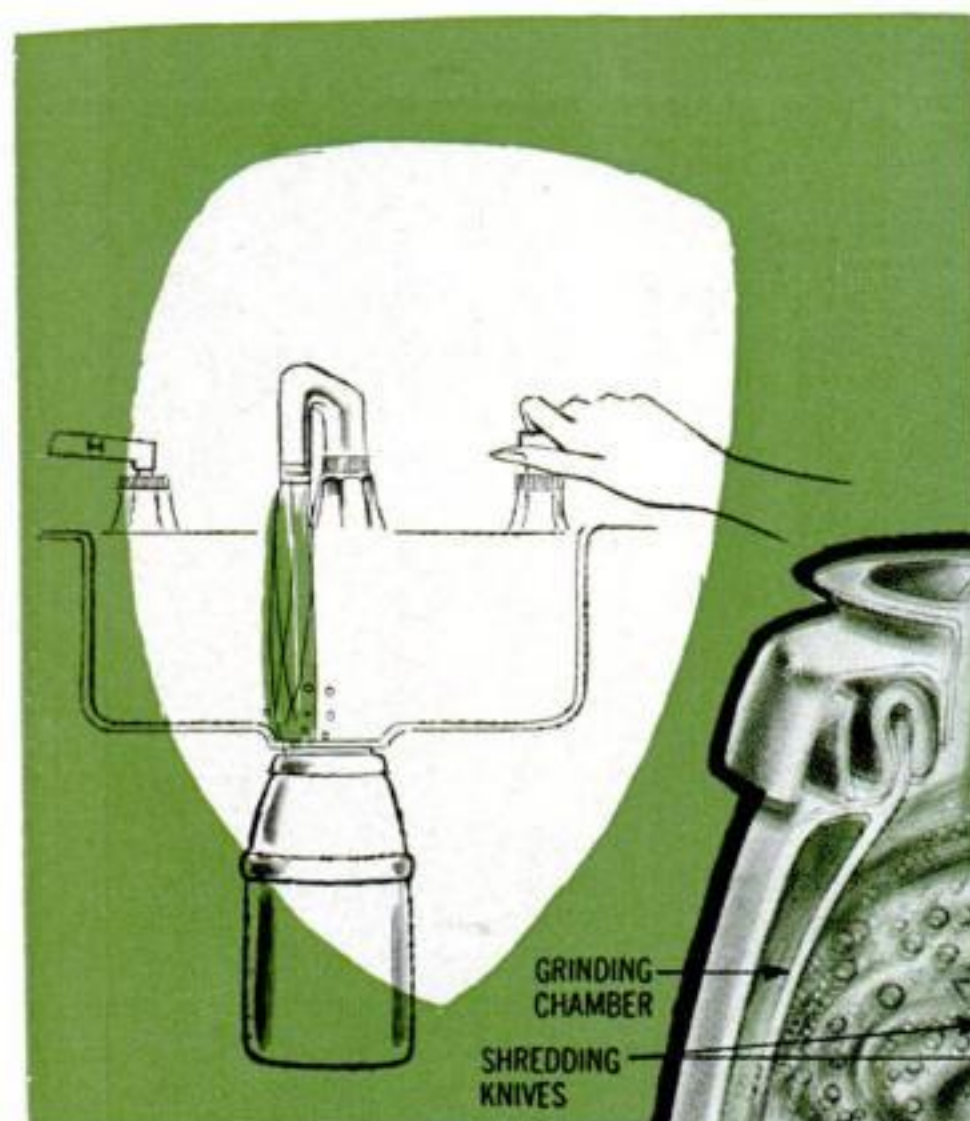
USE 28-gauge sheet copper for the sides and barrel or, if the planter is to be painted, 28-gauge galvanized iron. Cut parts and fold the seams at the two ends of the barrel. To burr (form a projecting edge on) the sides, saw or turn two 6" disks from hardwood and clamp them together, with one metal side sandwiched between them. Bend the projecting stock down with a succession of light hammer blows, working step by step around the periphery. Burr the other side.

Next, turn or sand down one of the burring blocks to $5\frac{5}{16}$ " diameter and saw it in half. Tin the inner faces of the burrs and the sections of the barrel sides that will be joined to them. Form the barrel and position it on one of the sides. Slip the halved hardwood disk inside the

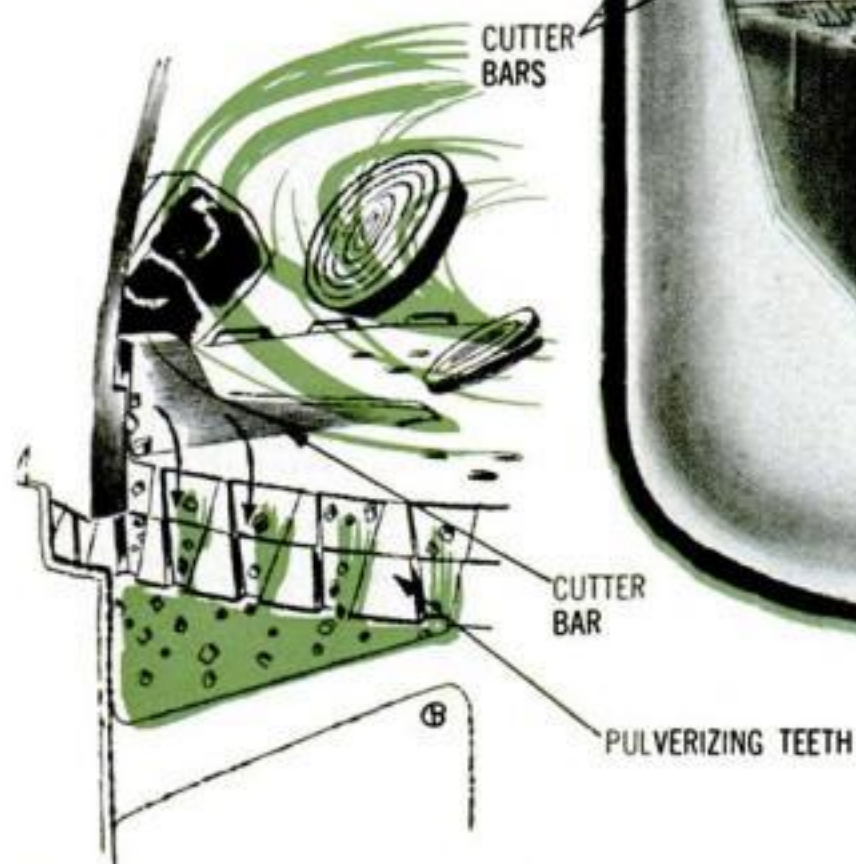
barrel to act as a backing block. Sweat-solder the seam with an iron or torch. Use the same method to attach the other side. Then remove the disk halves through the throat of the planter. Roll the upper sections of the sides outward over a bar or dowel.

If the planter is for table-top use, lay out and cut a base from matching 28-gauge metal. Bend the side hems inward, then fair the end laps slightly outward. Finally, bend inward on lines A for a fit with the barrel. Tack-solder the center of the base to the bottom of the planter and sweat-solder the laps to the sides of the barrel. For a suspended planter, solder a pair of ears to the barrel sides to hold the end links of an 18" section of brass-plated sash chain.

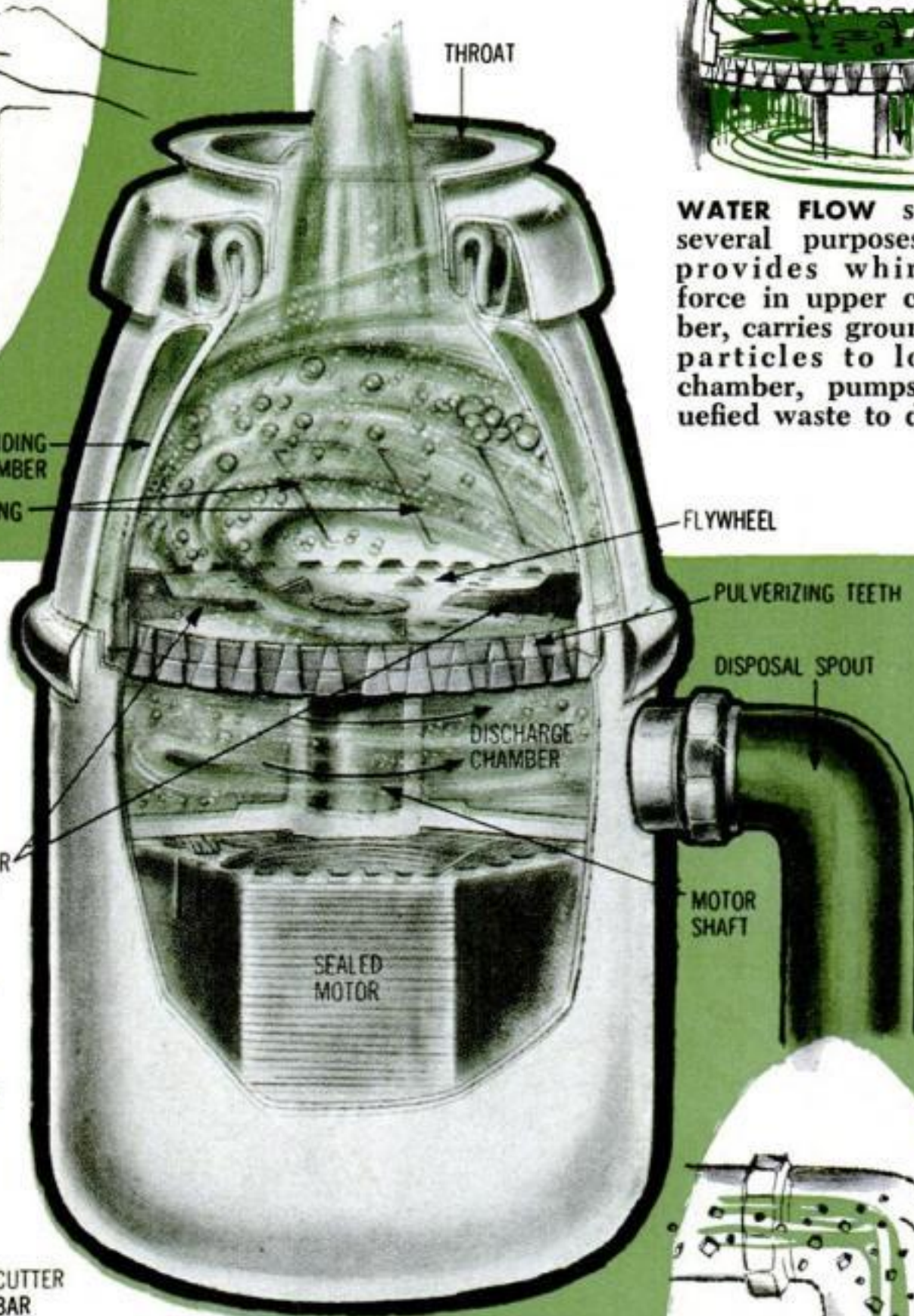




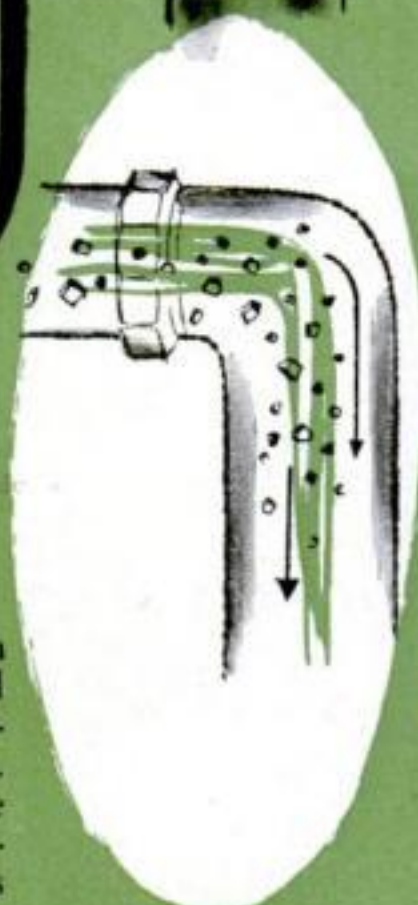
COLD WATER is turned on and let run briefly before the disposer is switched on. With the water kept running in moderate flow, food wastes are fed into the sink opening.



CENTRIFUGAL FORCE, created by the flywheel, sets up a whirlpool that throws food wastes against the wall of the grinding chamber with terrific impact, as shown above. Cutter bars and shredding knives break up and grind the solids into small particles. Force of the water carries these past pulverizing teeth into the lower chamber, which acts as a centrifugal pump.



WATER FLOW serves several purposes. It provides whirling force in upper chamber, carries ground-up particles to lower chamber, pumps liquefied waste to drain.



END PRODUCT in drain line is a liquid carrying minute particles of solids. These are acceptable for treatment by municipal sewage plants and septic tanks.

Money-saving background facts
for prospective buyers:

The Controversial Garbage Disposer

By Herbert O. Johansen

KITCHEN-SINK waste disposers are a hot-selling item and those who own one wouldn't be without it. Yet in New York, biggest city in the U. S., you couldn't have one—they're illegal. In Detroit, on the other hand, you couldn't build a new house without one.

Garbage grinders have had a hard fight for social acceptance ever since a man in Racine, Wis., handmade the first one some 30 years ago—and the fight is still going on.

Besides New York City, more than 100 other communities in the United States turn thumbs down on the device, arguing that a widespread use would overload their sewage-disposal systems. In New York they are ruled out by an old law that says "no foreign matter may be introduced into the municipal sewage system."

Chicago only recently made them legal, going along with such other large cities as Los Angeles, San Francisco, Cleveland, Houston and Washington.

Detroit requires them in all new homes;

FACTS AND FIGURES:

Kitchen Waste Disposers

MAKE	MODEL	APPROXIMATE LIST PRICE	DIMENSIONS (height x under-sink diameter in inches)	MINIMUM ROUGH-IN (inches)	TYPE OF FEED	CUTTER ACTION	MOTOR (hp.)	REVERSING ACTION?	DISHWASHER CONNECTION?
AMERICAN STANDARD	AS-65	\$80	10¾ x 7½	5	continuous	fixed	1/3	yes	no
	AS-65D	\$83	10¾ x 7½	5	continuous	fixed	1/3	yes	yes
FAIRWAY (Montgomery Ward)	SGL-530A-75	\$48	13¼ x 7¾	6¾	continuous	swivel	1/4	no	yes
FRIGIDAIRE	FDZ-3	\$60	13¼ x 7¾	6¾	continuous	fixed	1/4	yes	yes
	FDZ-1	\$99	14¾ x 8	8	continuous	fixed	1/4	yes	yes
GENERAL ELECTRIC	FC-20	\$60	14¾ x 7¼	7	continuous	swivel	1/3	no	yes
	FA-60	\$80	15¼ x 8	7¾	batch	swivel	1/3	no	yes
HOTPOINT	MW15	\$60	15 x 7¾	8¼	batch	swivel	1/3	no	yes
IN-SINK-ERATOR	333	\$60	12 x 6½	6	continuous	fixed	1/3	no	yes
	27	\$140	15½ x 6½	7¼	both	fixed	1/2	yes	yes
KENMORE (Sears, Roebuck)	6417	\$45	11¾ x 7½	6	continuous	fixed	1/3	no	no
	6418	\$55	12¼ x 7½	5	continuous	fixed	1/3	no	no
NATIONAL	254A	\$90	14¾ x 8¾	7½	continuous	fixed	1/3	yes	yes
	744A	\$120	14¾ x 8¾	7½	batch	fixed	1/3	yes	yes
PHILCO	D-6081	\$70	12 x 6½	6	continuous	fixed	1/3	yes	yes
PIONEER	D57	\$57	13¼ x 7¾	6½	continuous	fixed	1/4	no	yes
RCA WHIRLPOOL	ECD 330	\$60	15½ x 6½	8	continuous	fixed	1/3	no	yes
	ECD 331	\$90	15½ x 6½	8	batch	fixed	1/3	yes	yes
WASTE KING	72	\$60	13½ x 7¾	6¾	continuous	swivel	1/4	no	yes
	IMP-1	\$130	15¾ x 9¾	8	continuous	swivel	1/3	no	yes
WESTINGHOUSE	FD-10	\$70	14½ x 11½	6¾	continuous	swivel	1/3	no	yes
WHIRL-A-WAY	SD70X	\$60	14 x 6½	6½	continuous	fixed	1/3	yes	yes
	SD700X	\$90	14½ x 7	7½	continuous	fixed	1/3	yes	yes
YOUNGSTOWN KITCHENS	FWD-100	\$80	10¾ x 7½	5	continuous	fixed	1/3	no	no
	FWD-100-D	\$80	10¾ x 7½	5	continuous	fixed	1/3	no	yes

in South Euclid, Ohio; Jasper, Ind.; Shorewood, Wis.; and Mt. Dora, Fla., every home, new or old, must have a food-waste disposer. The goal is complete elimination of garbage collection.

Are they legal in your area? That's the first thing you'll have to find out if you're in the market for one. Despite the restrictions, more than 4,000,000 homes now have them, and sales during 1958 topped \$50,000,000 for some half-million new units.

Goodbye to the garbage pail. A disposer does away with the messy accumulation of food wastes in the kitchen and the soggy bundles that have to be dumped in a garbage pail. It does not, of course, solve the trash problem. Paper, cartons, bottles and tin cans still have to be collected or disposed of.

Some of the cheaper models, despite manufacturer claims, will not grind steak bones, corncobs and husks *efficiently*. Corn husks are especially difficult because of their long, tough fibers. A length of string or a dishrag can snarl up the best disposer. As for big steak bones: "Our disposer may not grind them up," admitted an engineer with a company that makes one of the better units, "but eventually it will wear them down."

How they work. Essentially, all home food-waste disposers do their job in the same way. Various combinations of cutter bars and teeth slice and shred solid matter as it is water-swirled against them by a horizontal flywheel spinning at 1,725 r.p.m. The chomped-up matter is then ground into tiny particles as it is

forced into a lower chamber, and finally washed down the drain by a constant flow of cold water from the sink faucet. Using *cold* water is important. It solidifies grease into globules that can be disposed of instead of clinging to the sides and parts of the machine.

There are differences, and they have their advantages and disadvantages. Method of feed is either *continuous* or *batch*. Most models on the market are the continuous-feed type. Some manufacturers make both.

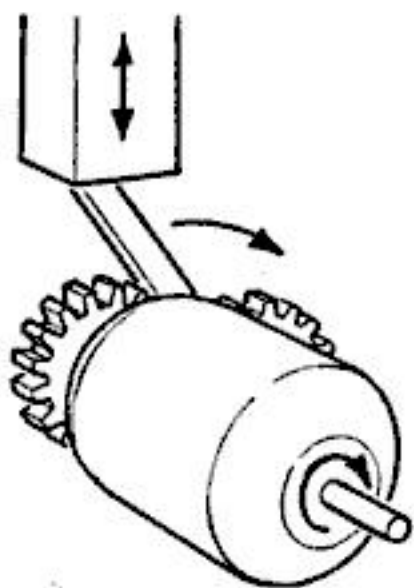
Continuous feed. The cold-water faucet is turned on, the motor started and let run for a few seconds to get the flywheel up to speed. Then food waste is fed in, either scraped off plates or by using the sink as a receptacle while paring or trimming vegetables, fruits and other foods. There are various types of stoppers, or covers, that can be adjusted to permit the sink to be used as a wash basin, or to let water flow through whether the unit is operating or not. With the cover on, the continuous-feed feature is canceled, but it does prevent silverware from slipping in and bone fragments from popping up at you.

Batch feed. In this type, a load of food waste, up to two quarts in the larger models, is put into the grinding chamber, water flow turned on, a cover put in place, and the motor started. It will not operate unless the cover is on. This is a safety feature for the timid and makes the inadvertent feeding-in of silverware less likely. Since it has to start with a full

[Continued on page 218]

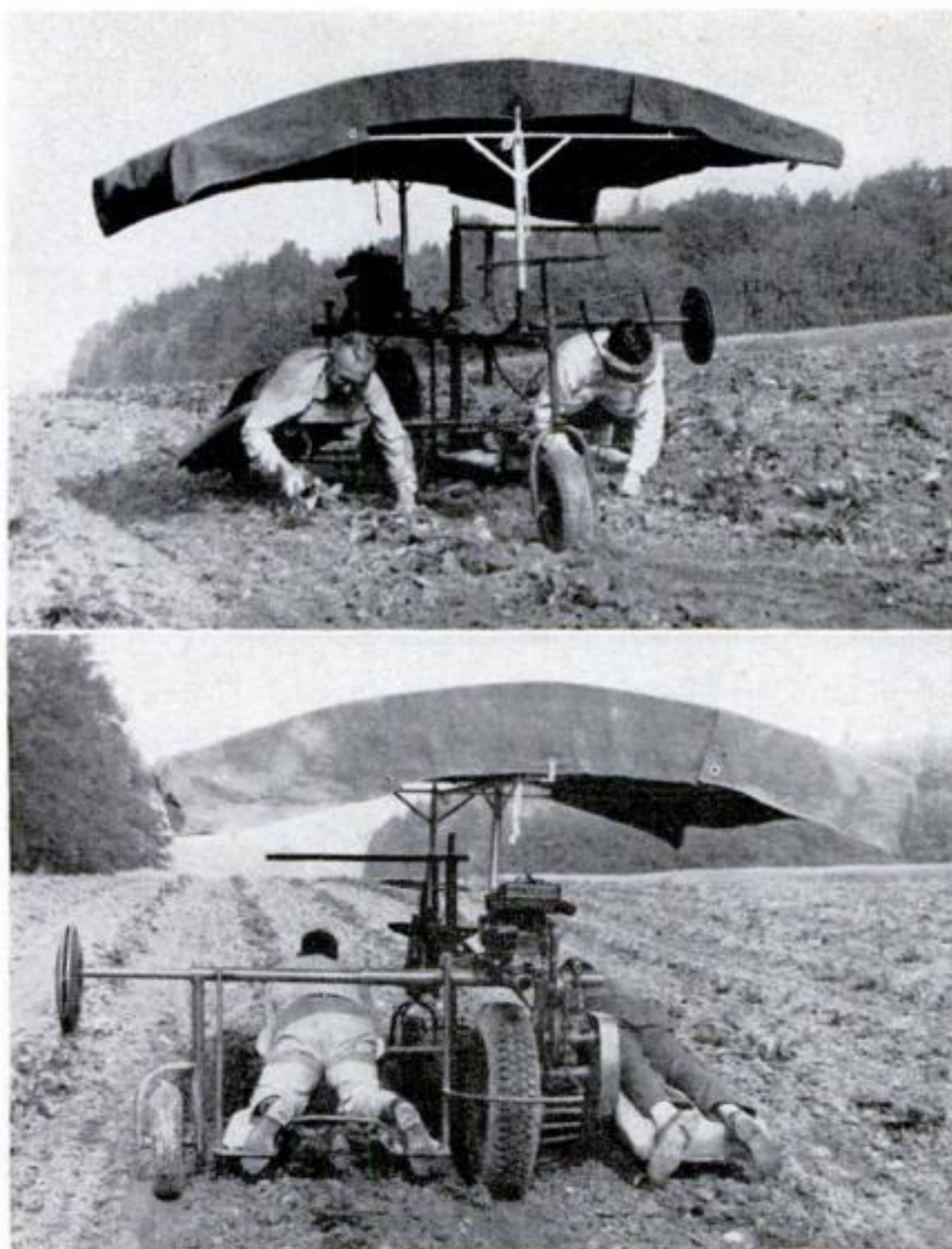
WHAT'S YOUR MECHANICAL IQ?

The Case of the Double-Speed Crank



A REVOLVING shaft in Mike's invention was to turn at twice the speed of a reciprocating member near it; that is, the shaft was to make two revolutions for one back-and-forth stroke of the other part. It seemed that an extra shaft, geared in a 2-to-1 ratio to the main one and fitted with a crankpin, would be necessary. In addition, a connecting rod or pitman would link the crankpin to the reciprocating part.

Consulting an old book, however, Mike found a solution that did away with the extra shaft. It used two gears of the same size in constant mesh, and astonishingly, one of these did not even turn! How was it done? See page 162.



Short Cuts and Tips

FROM PS READERS

Weeding Machine for Strawberries

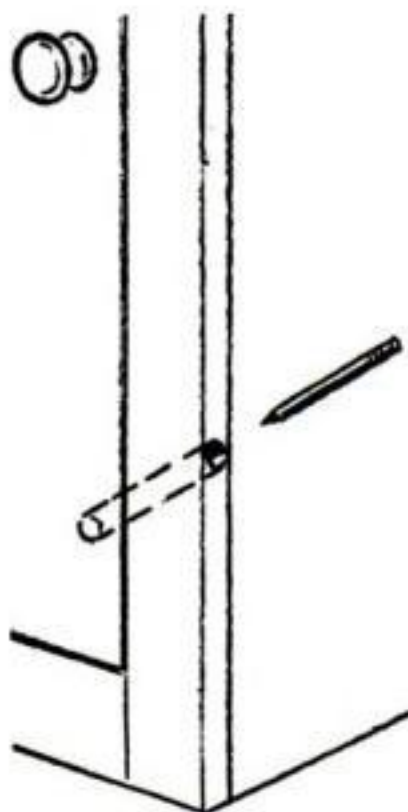
STRAWBERRY grower L. S. Garver of Mahoning County, Ohio, built a motorized weeding machine that takes much of the work out of keeping his fields clear, speeds the job considerably and makes it more thorough.

Driven by a 2 $\frac{1}{4}$ -hp. air-cooled gas engine, the machine straddles two rows so two men, lying on form-fitting pads, can weed as it moves slowly forward.

Stirrups under the feet of one operate a throttle that regulates speed. The steering wheel locks on a straight course. A tarpaulin keeps off sun.—*John Krill, North Lima, Ohio.*

▶▶▶IN MY work as an electrician, I use ordinary modeling clay instead of friction or plastic tape to insulate connections made with so-called split-bolt or solderless connectors. It seals out air and moisture, remains pliable and is cheaper, too, than electrician's tape.—*William Edmund Frazer, Kewanee, Ill.*

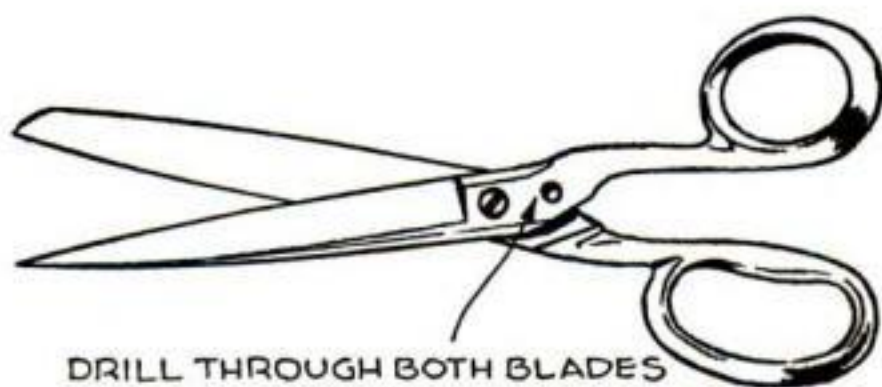
▶▶▶I CLEAN rusty tools by immersing them in hot water containing a tablespoon of ammonium citrate to the pint. Then I rub with steel wool when the rust has disintegrated, rinse in clear water and dry in the oven. Finally I coat the metal parts by dipping in self-polishing wax.—*Edwin St. John, Dedham, Mass.*



Magnetic Lock Outwits Pliers

You can lock a private cabinet, in a way known only to yourself, with headless nails slipped into holes drilled through the side into the edge of the door near the top and bottom.

To open, simply draw out the nails with a small magnet.—*Michael Goodbody, San Diego, Cal.*



DRILL THROUGH BOTH BLADES

Cutting Wire with Scissors

You can cut small-diameter wire with a pair of household scissors if you drill a hole through both blades when they're clamped partially open. Locate the hole close to the fulcrum screw to obtain good leverage. A hole $\frac{1}{16}$ " or $\frac{3}{32}$ " should be large enough.—*F. Murray, Chicago.*

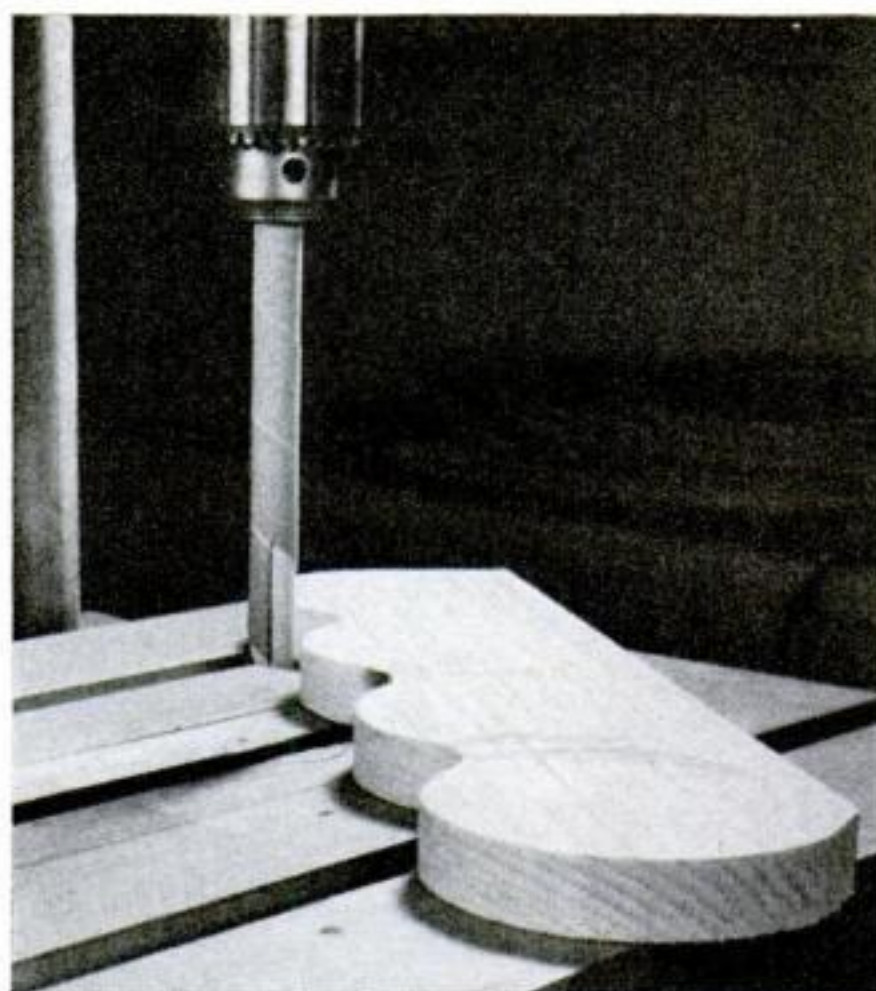
Short Cuts and Tips

FROM PS READERS



Flowerpot Waterer for Poultry

A SIMPLE poultry waterer can be made from a clay flowerpot and an old soup bowl. Stop the hole in the flowerpot with a cork or wooden plug, fill with water and place the bowl on top. Then invert them. Water will seep out as the chickens drink and the pot will keep the water cool.—*John Krill, North Lima, Ohio.*



How to Make a Sanding Stick

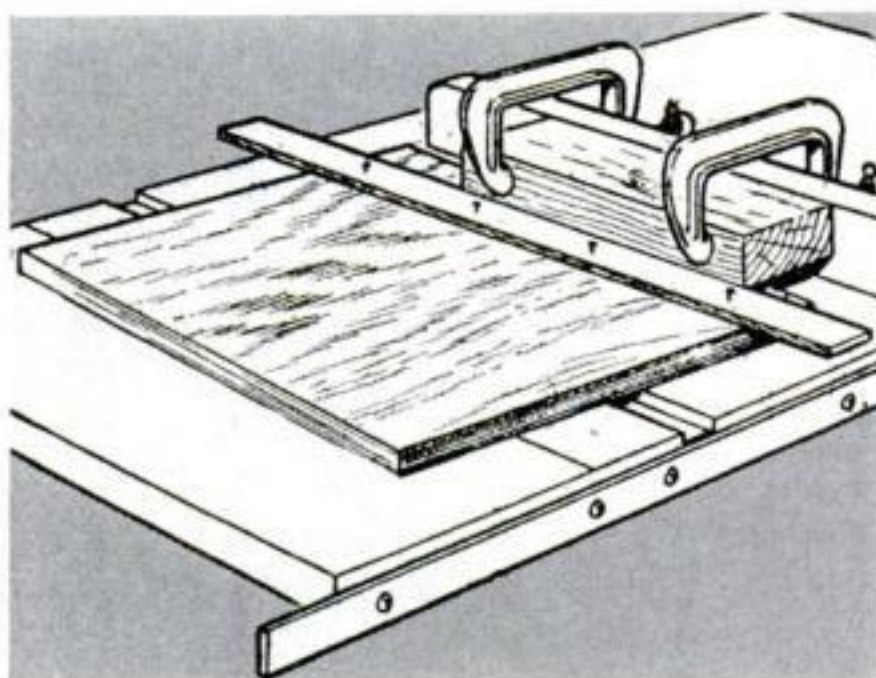
INSTEAD of going to the trouble of trying to glue sandpaper to a dowel for a drill-press sanding stick, you can slot the dowel near the end and insert the end of a strip of sandpaper in the slot. Then spiral the paper around the dowel and grip the free end in the drill chuck.—*R. J. De Cristoforo, Los Altos Hills, Cal.*



Oiling Small Motors

DAMAGE by too little or too much oil in motor bearings can be prevented if you insert a measured quantity with a visual medicine dropper at regular intervals. This is more positive than lubricating with a conventional "blind" oil can.—*Dan Anderson, Toronto.*

▶▶▶To STIFFEN fuzz on soft wood and make sanding easier, first apply a wash coat of thinned shellac and let it dry.



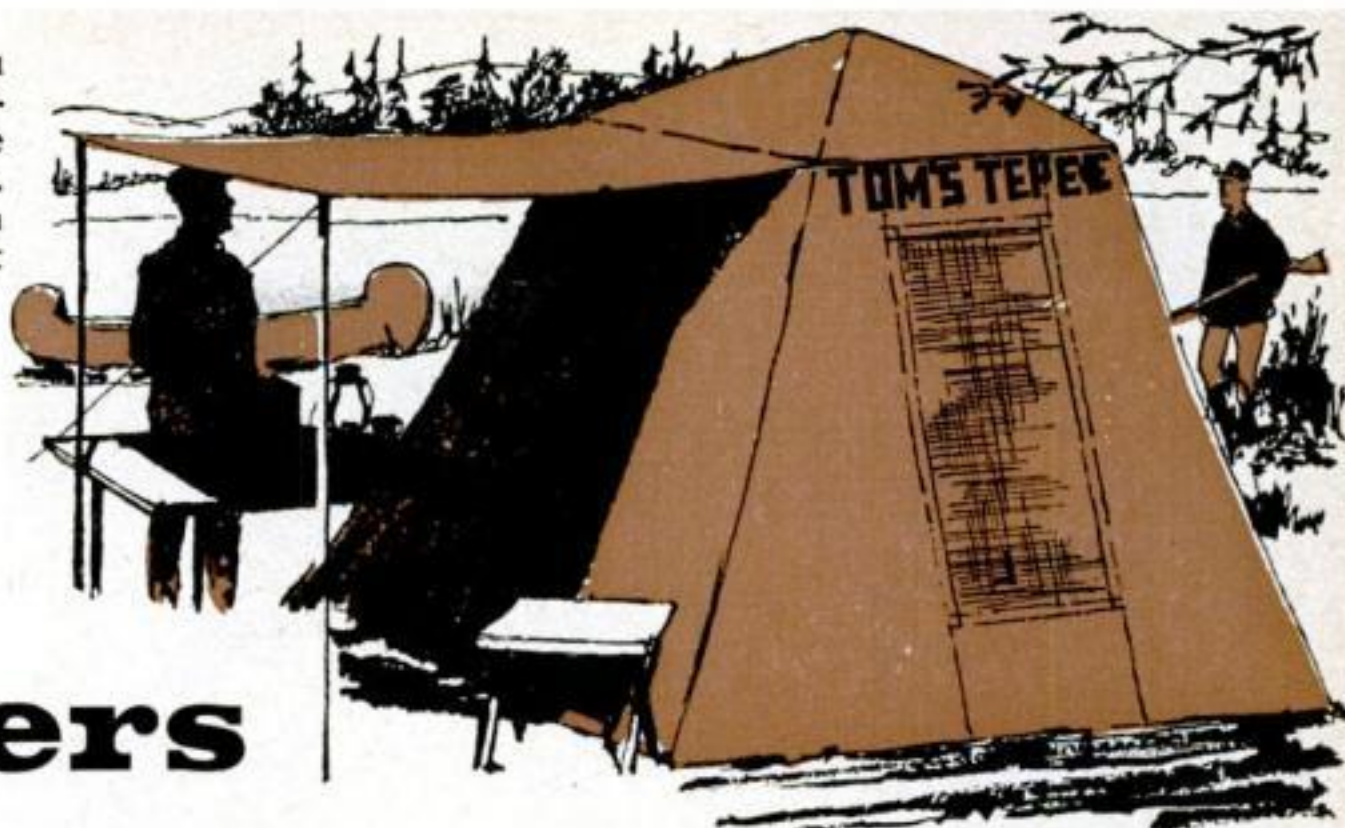
Quick Guide for Cutting Tapers

WHEN you have to cut a one- or two-of-a-kind taper that doesn't justify making a taper-cutting guide, you can rig one up quickly this way. Just nail a plywood straightedge on the exact line of the taper, clamp a block to the fence and use it as a guide on which the straightedge will ride. Be sure to set the fence so the outside edge of the block will be aligned with the outside edge of the saw blade.—*Robert Rempel, Petaluma, Cal.*

NAME YOUR TENT as you would a lakeside cottage. Buy mending tape in a contrasting color. Cut it into strips to form the name and press it on with a hot iron.

Tips for Tenters

By Ken Murray



A SCRAPER to clean mud from shoes before entering the tent can be improvised by pushing the camp shovel deep into the ground at the entrance. Use the top edge of the shovel.



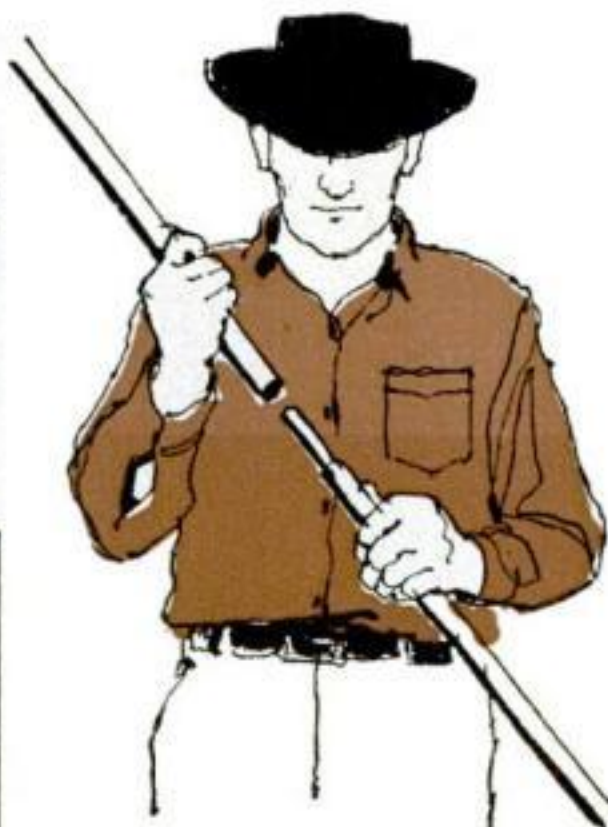
TO BLAZE A TRAIL, don't slash trees with an axe. Carry along a small can of pressurized white paint, and mark the trees easily and quickly with short bursts.



CLOTHES HANGERS can be supported on a tent wall by pressing loops of mending tape to the canvas with a hot iron. Use two or three thicknesses to replace worn guy-rope straps.



BEST LIGHT FOR SHAVING is at the front tent pole. Attach shaving mirror by slipping long cotter pin on wire frame of mirror and running shank of pin through a hole drilled in pole.



MODERN TENT POLES: Wooden poles can be replaced with 1" aluminum tubing. You can make the poles in two sections, joined by dowels pressed into the ends.



IF A TENT LEAKS during a storm, dripping into the center area, pin a string to inside of wet spot and lead the string to the side of the tent. Drops of water will follow the string.



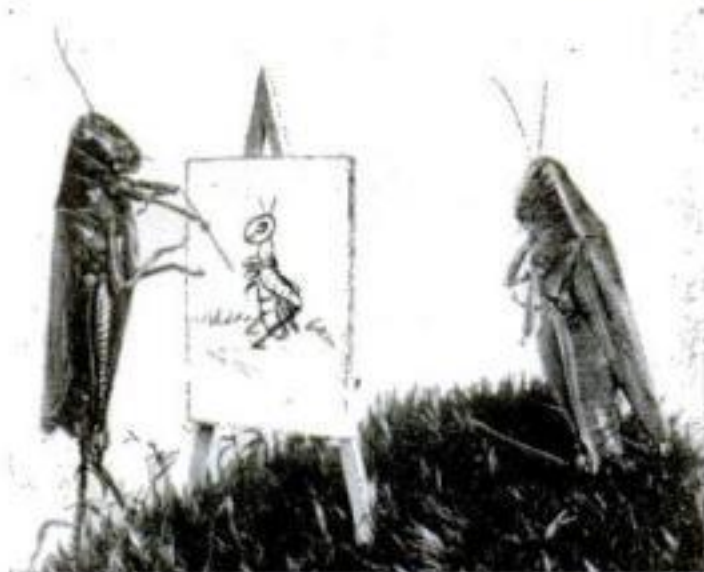
CREATING LIFELIKE SCENES in miniature is Dr. Lehman Wendell's way of relaxing. The Minneapolis dentist arranges his insect "actors" with dime-store props. Their stage is the top of a table in the basement; lighting is supplied by two ordinary bulbs, one on each side. Dr. Wendell snaps the scenes with a single-lens reflex camera and does his own processing.

Here's an unusual photographic hobby:

Table-Top Photos of Grasshoppers

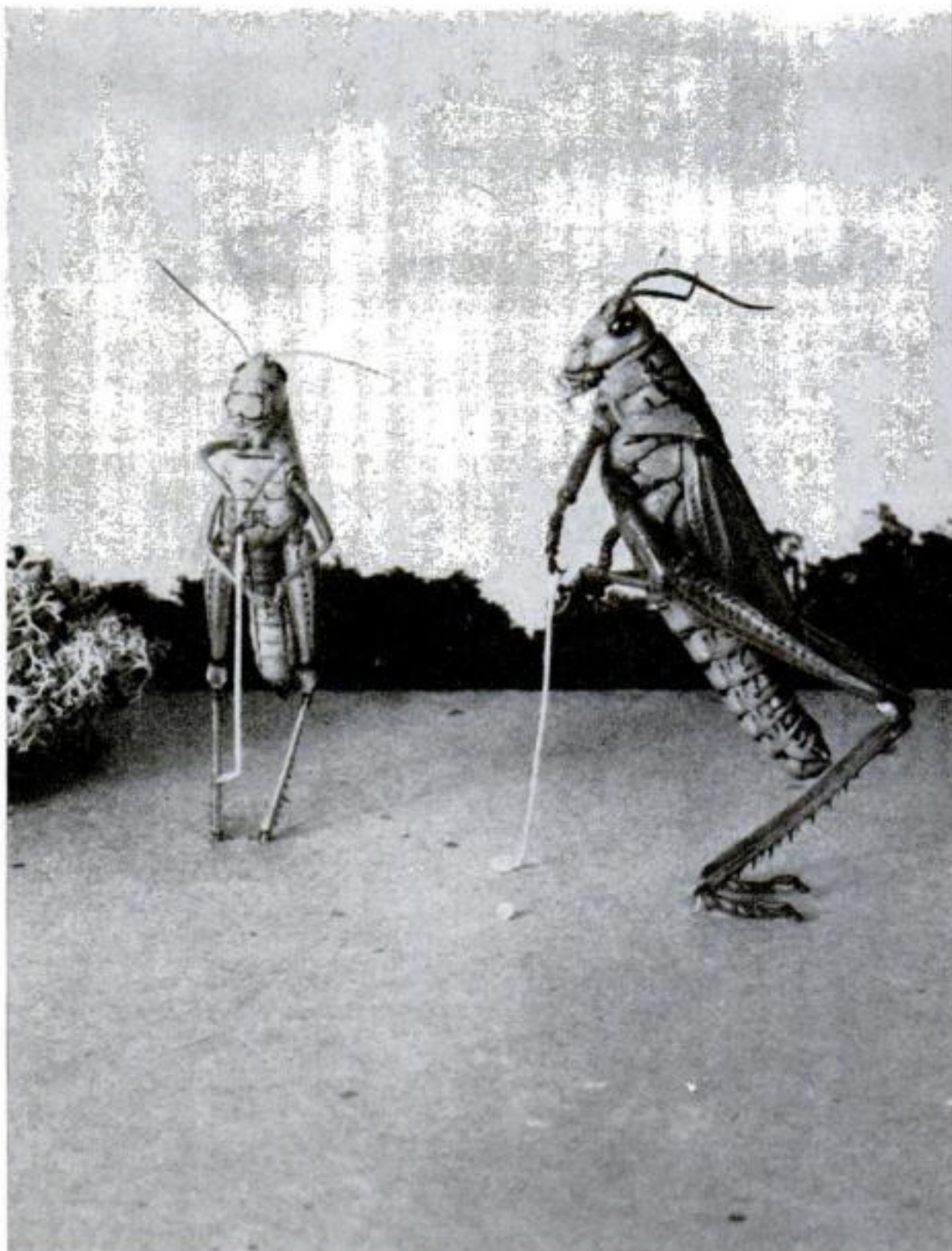


HE'S ROCKETING TO THE MOON on a meat skewer disguised with paper fins.

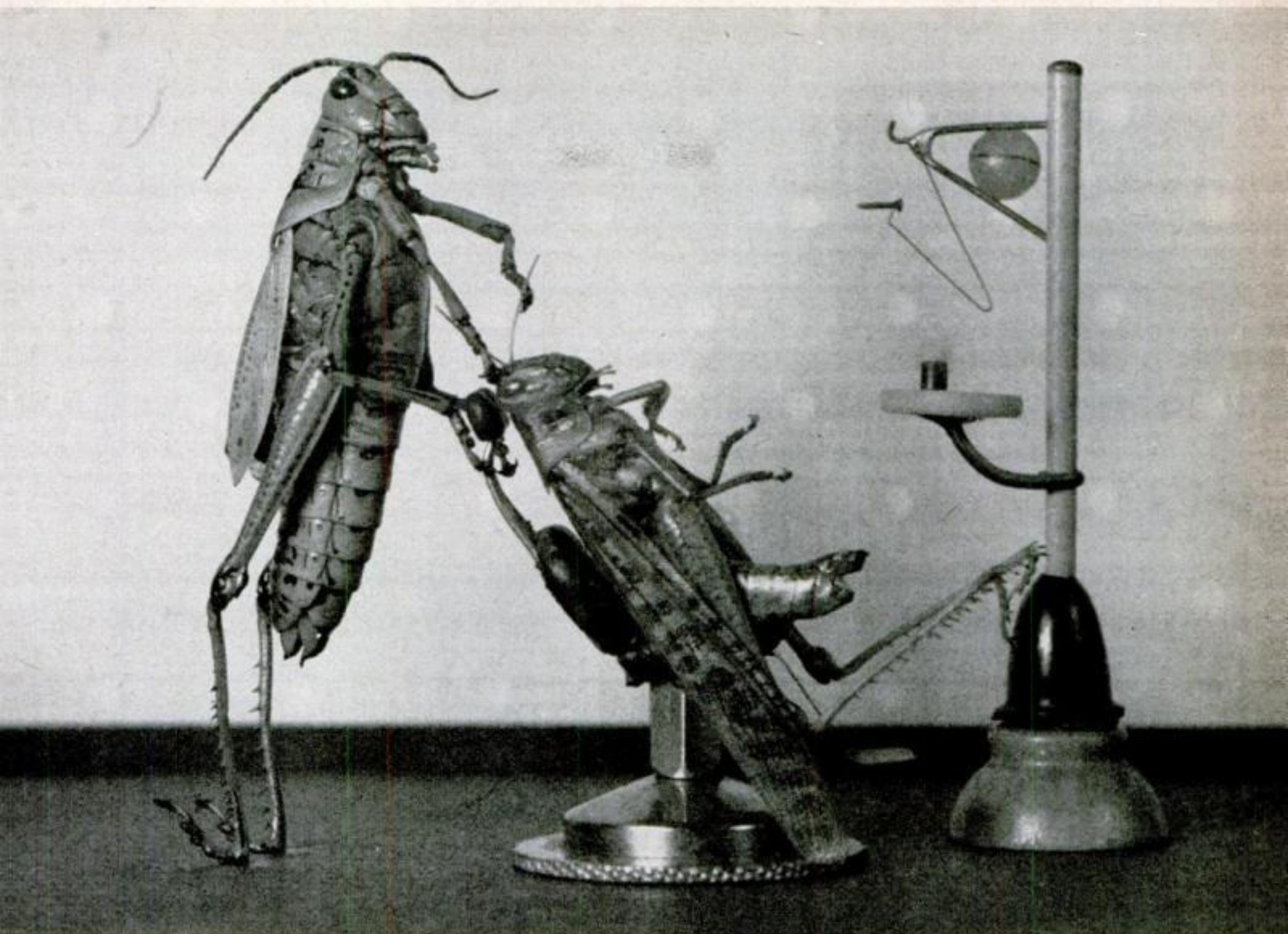


THIS ARTIST set his canvas on an easel made from a strawberry box.

FLYING A KITE is easy for these fellows—a hidden wire holds it up.



LINING UP A SHOT, a tiny golfer swings his straw putter at a ball made from sugar.



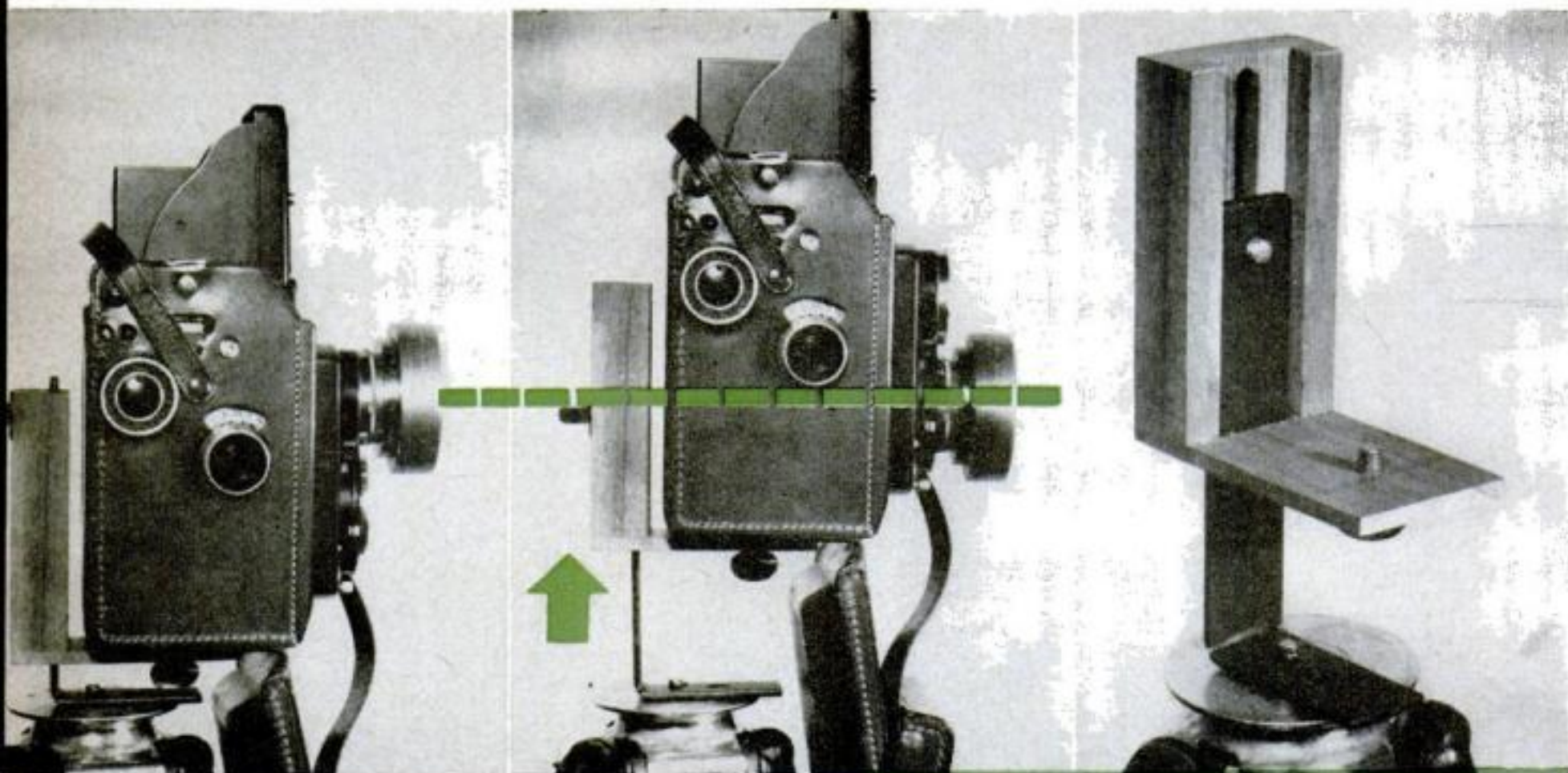
"Open wide, please," says the four-armed dentist. This was an obvious vignette for Dr. Wendell.



AN ANTIQUE CAR MODEL, salvaged from an advertising display, has its driver at a tiller.



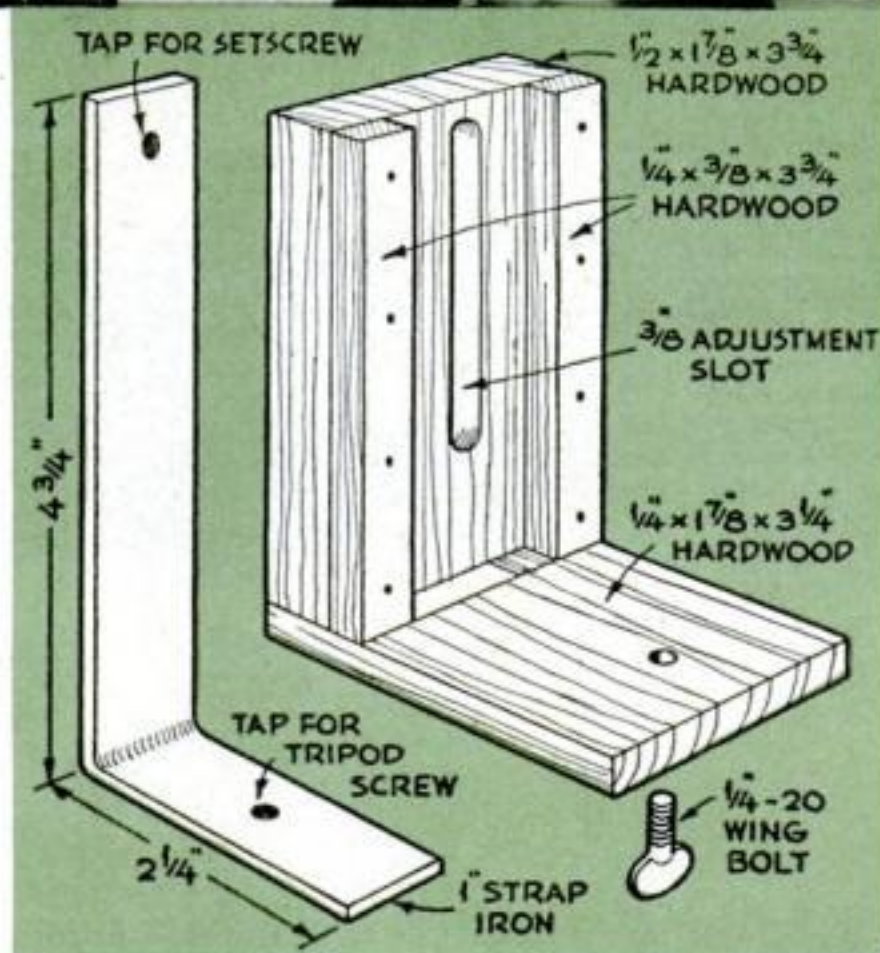
A FISHERMAN who's more often the bait tries his luck. The "pond": a baking pan of water.



Twin-Lens Takes Close-Ups

CLOSE-UPS are a problem with twin-lens reflex cameras: When you focus with the viewing lens, the taking lens is too low. A homemade device that fastens to a tripod head licks this problem. It raises the taking lens to viewing position. The close-up attachment—a portrait or Proxar lens—is moved from viewing to taking lens when the camera is raised.

How far the camera moves is determined by the length of the adjustment slot in the device. You arrive at this by measuring the distance between centers of the camera's two lenses (it's $1\frac{3}{4}$ " on my camera). Start the slot by drilling holes that far apart with a $\frac{3}{8}$ " drill; then join them with saw cuts.—*T. C. Van Alstyne, Don Mills, Ontario.*



Projector Edits Film, Too

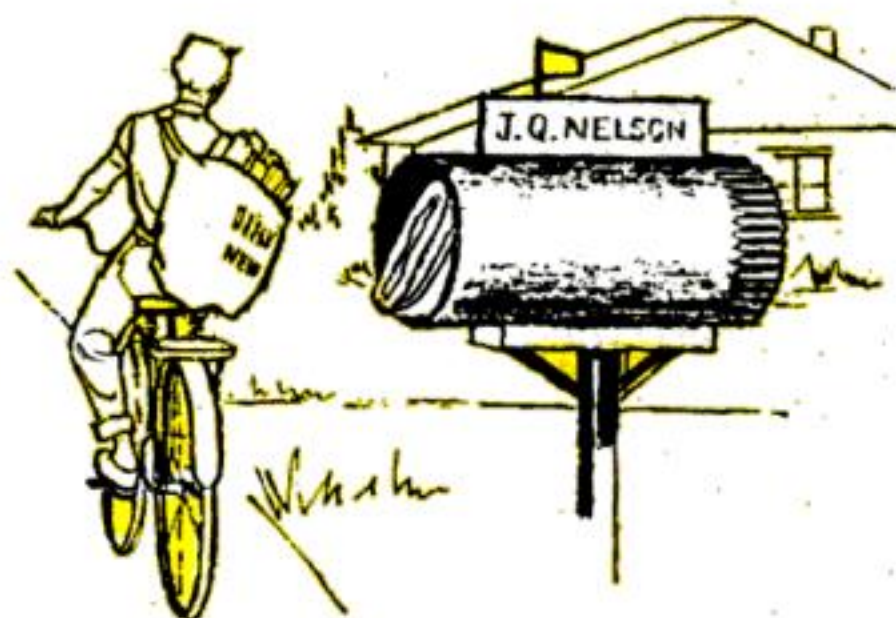
EVERYTHING you need to prepare and project 8-mm. movie film is found on Keystone's K-110 projector. A butt-splicer fits into its base and a 3" viewing screen is built into the side for editing. The projector itself is operated by pushbuttons and has a new 21-volt, 150-watt lamp said to produce as much light as a conventional 750-watt bulb.

An automatic switch in the projector turns on a table lamp plugged into its base when the projector stops. When the projector starts running, the light goes off automatically. Manufacturer's suggested price: \$199.50.

5 Budget Savers

1 Want a weatherproof holder for your daily newspaper? You can make one from a short length of stovepipe.

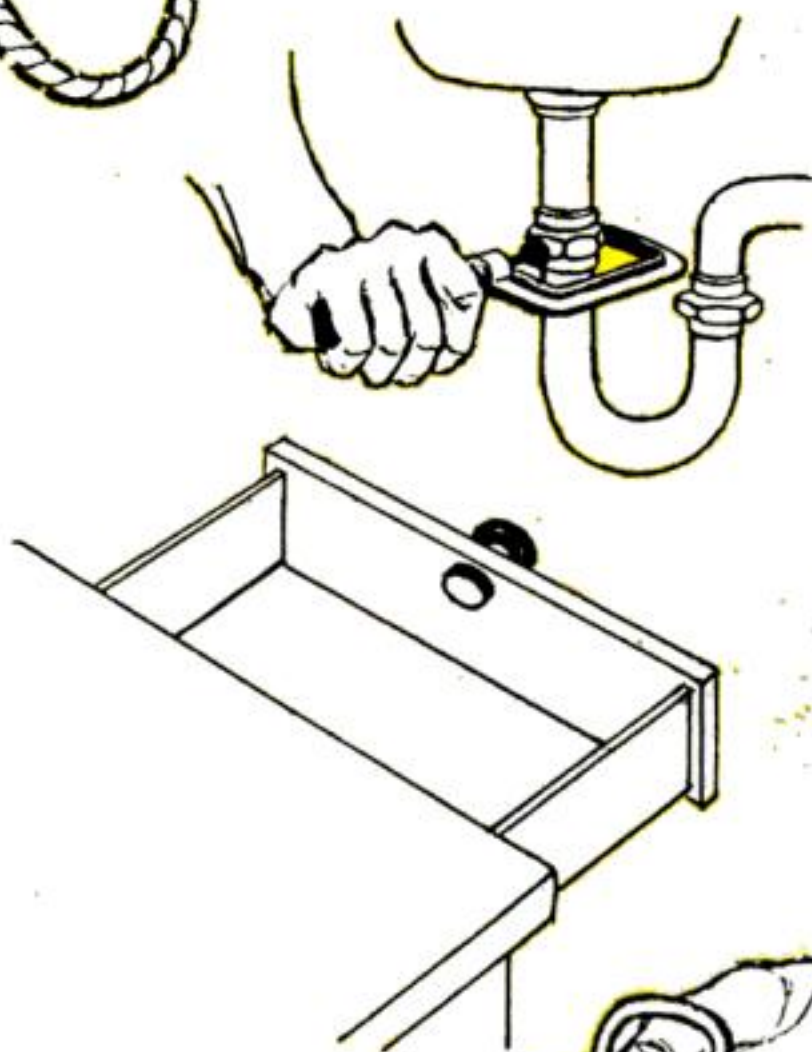
If the pipe is too large in diameter, open it at the seam and overlap the edges to make it the size you like best. The holder may be mounted on a ground post or hung from a house wall on wire. Paint or lacquer it to discourage rusting.



2 Rubber cords on power tools take a beating. You can extend the life of yours—and keep them from kinking, too—by splitting rubber tubing and taping a length over wear points on each cord.

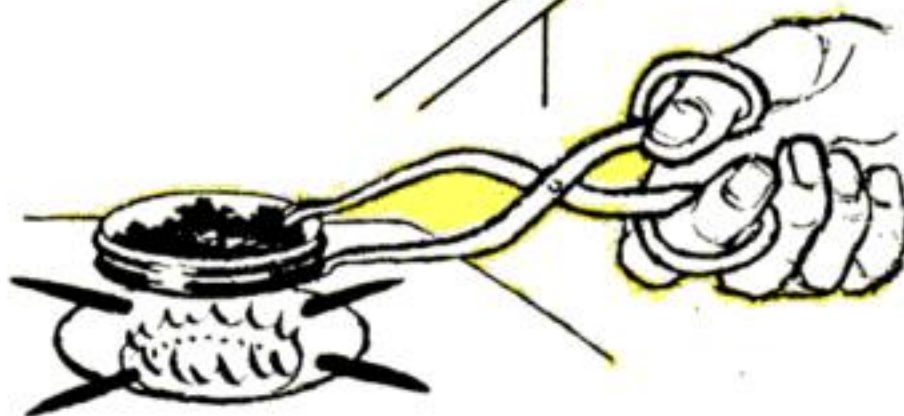


3 No wrench big enough to do the job of opening a sink or lavatory trap? You can make do with a C clamp. It can be adjusted to the required size and it won't scratch chromium plating.



4 Snags in clothing or table linens often result from drawer-pull bolts that project on the inside of dresser or buffet drawers. Cover such snag producers with plastic bottle caps filled with wood paste. Press the cap over the bolt end while the filling is still soft.

5 Crumbling shoe polish? If a wax-base polish breaks up in the can, place the can over low heat just long enough to melt and join the wax. Be careful heating it, as with any grease on the stove.



With easier loading, lower cost and longer playing time, tape is battling for a place in your stereo sound system

What's Coming in Stereo Tape

By Robert Gorman

AS A medium for recording and reproducing sound, magnetic tape is admittedly in a class by itself—and some of its best friends wish this weren't so. They'd like to bring tape down from its lofty eminence and give it a larger place in home music systems.

Tape recorders, of course, are included

in many thousands of high-fidelity rigs, but really wide popularity has so far eluded the oxide-coated ribbons. Two main reasons: the high cost of recorded tapes and loading complexity.

Now several developments promise to open new doors by slashing the price of program tapes and simplifying recorder operation. The main ingredients:

- Lowering the tape speed needed for

RCA cartridge: Standard for the industry?

ADDING new convenience to the economy of long-playing tapes, magazine-loading systems eliminate threading and reel handling, minimize rewinding, and simplify tape playing.

Leading contender among cartridge designs is RCA's 1/2"-by-5"-by-7 1/8" plastic package, which can be played only on its special deck. RCA has offered the design to other makers.

Advance models began appearing in trade shows a year ago, but the promised follow-up of production units has been repeatedly postponed. By latest report, they'll be in the stores this summer.

A tape reel that can hold up to one hour of stereo is preloaded in the magazine. It travels from supply to a take-up hub around a pair of corner guides, and traverses nine apertures molded in the front edge of the cartridge. Recording and playback heads, drive capstan, positioning pins, and an automatic shut-off lever fit into the apertures, so all threading operations are made simply by dropping the magazine in place.

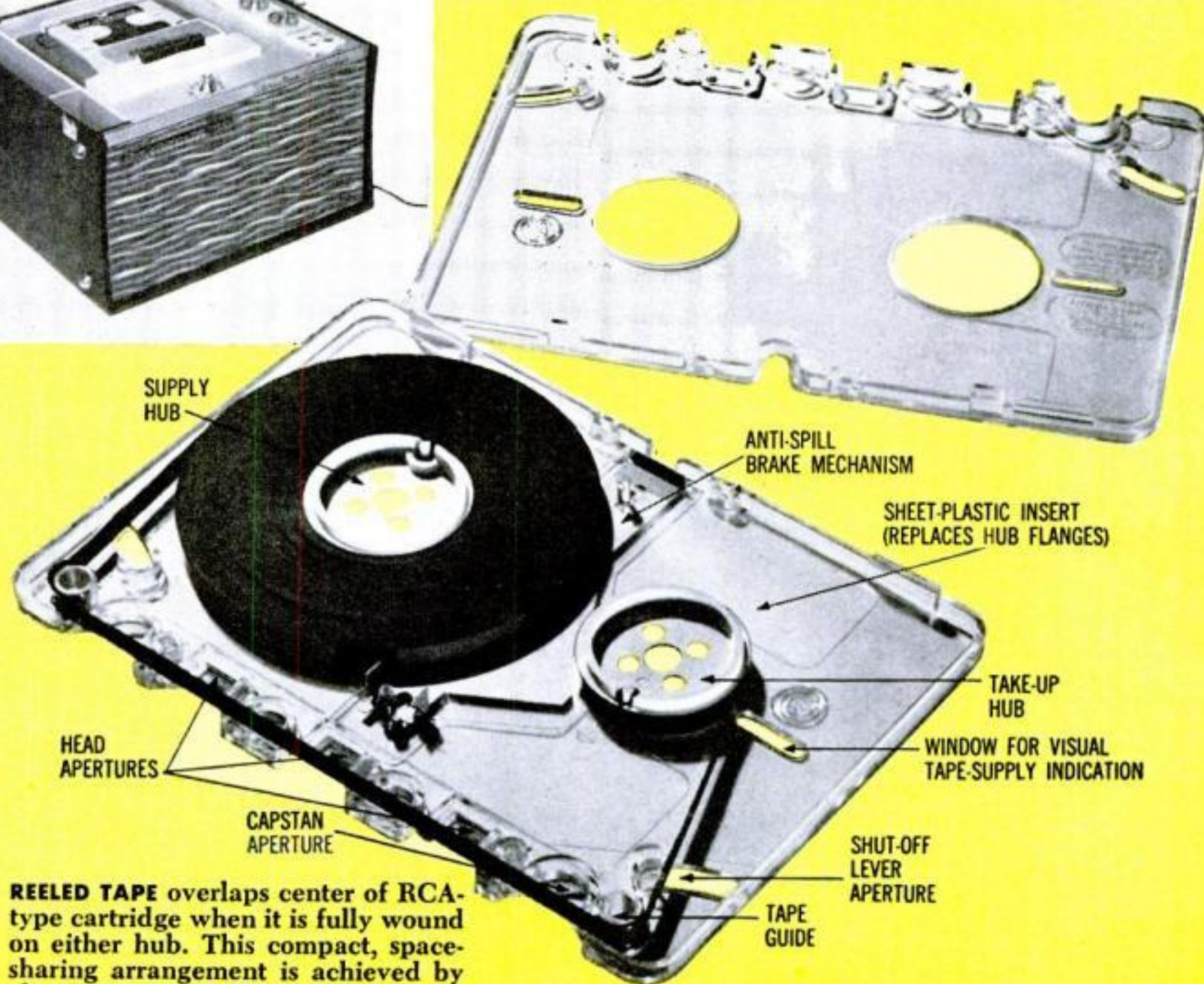
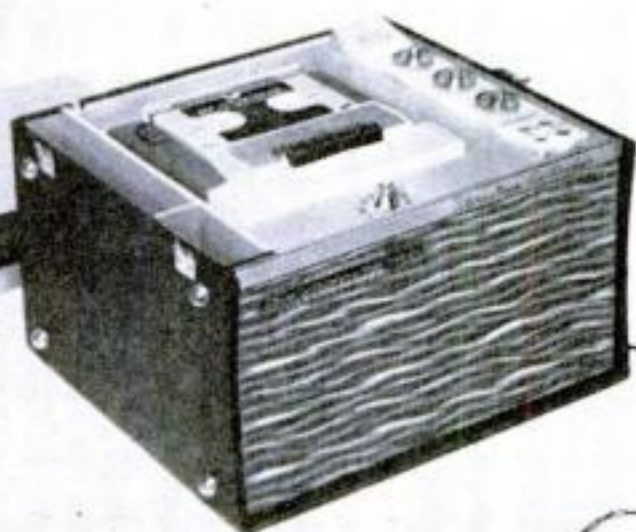
The automatic shut-off lever "feels"

the amount of tape left to play and stops the tape transport. Flipping the cartridge plays the second pair of channels. A built-in brake keeps the tape from spilling.

Price will range from about \$7 to \$9 for recorded tape; around \$5 for blank tape cartridges.

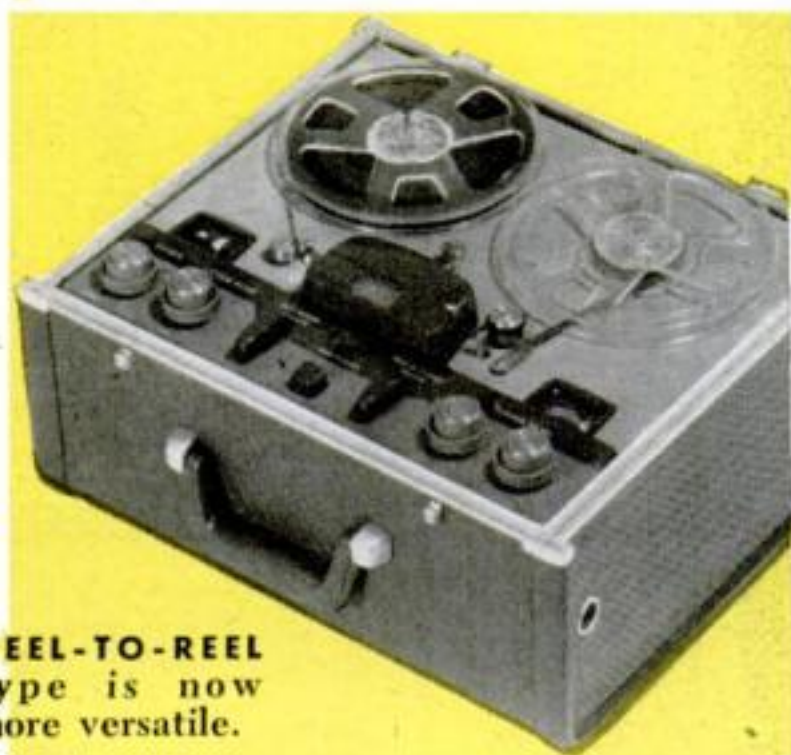


MAGAZINES add record-changer convenience to lowered cost of new, long-playing stereo tapes. Home recordings will use blank tape cartridges.



REELED TAPE overlaps center of RCA-type cartridge when it is fully wound on either hub. This compact, space-sharing arrangement is achieved by eliminating reel flanges.

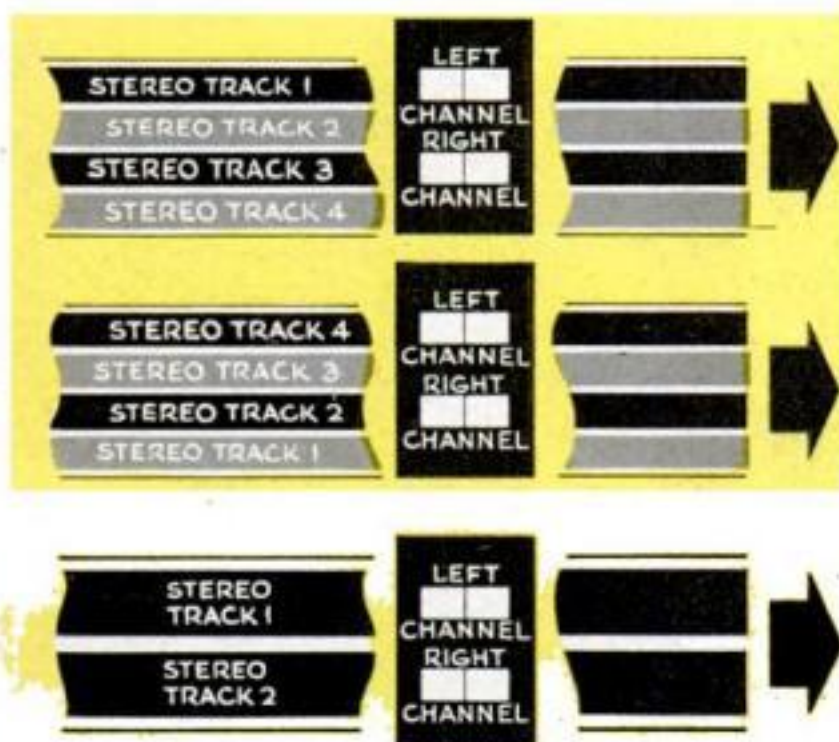
New heads update reel-to-reel machines



REEL-TO-REEL type is now more versatile.

NEW models of the familiar reel-to-reel tape recorders are keeping up with the latest developments. They can offer more versatility than the magazine-loading machines. With new narrow-gap, shorter-pole stereo heads and improved transport machinery, they can play either the new long-play tapes or two-track, 7½-i.p.s. tapes.

Track alignment of the two types is close enough for either to be played with the new heads, but at least one make (Ampex) has an adjustment to align heads for optimum response with either system.



ALIGNING SOUND TRACK: Flipping four-track stereo reel brings second pair into position (middle). Bottom: two-track reel.

high fidelity from 7½ to 3¾ inches per second (i.p.s.), thus doubling playing time.

- Squeezing four sound channels instead of two onto standard tape for a similar gain—and a total four-fold increase.

- Packaging tape in self-threading cartridges that make playing tapes as simple as playing ordinary records.

It's the booming interest in stereo sound that has triggered these new developments in tape playing. Practical stereo got its start on tape. A lot of hi-fi enthusiasts who could afford the tab (up to \$18 for a half-hour of recorded stereo tape) and master the intricacies of threading a tape machine were delighted with the results. But when the single-groove stereo disc hit the market, tape stereo was practically buried in the rush to this lower-cost, more familiar route to stereo.

Now magnetic players are priming for a comeback. The addition of new economy and convenience to the old advantages of tape could make it first choice for home music reproducers.

What are the advantages of tape?

- You can make your own recordings.
- You can erase and re-use the same tape.

- Tape doesn't get noisy with use.

- It never wears out.

- It has potentially unlimited fidelity.

High fidelity requires an upper frequency limit of 15,000 or 20,000 cycles; in television recorders, magnetic tape handles up to four million cycles.

There's a difference, of course, between potential and actual fidelity. Quality suffers when tape speed is lowered and tracks are added. This is why engineering refinements have been necessary to bring long-play, hi-fi stereo tapes into being.

Frequency response depends on the time it takes for any cluster of particles in the tape coating to pass the space separating the poles of an electromagnetic head. But this gap-crossing interval can be shortened either by raising tape speed or by narrowing the pole spacing. To obtain hi-fi response at 3¾ i.p.s., head gaps have been shaved to less than one ten-thousandth of an inch.

As tape speeds go down, any unevenness in the rate of tape travel causes more noticeable "flutter" and "wow." This has

Two self-loading cartridges that you won't see

MAGAZINE-LOADING tape machines have been developed in prototype by two other magnetic-recording pioneers—the Armour Research Foundation (which holds most of the basic patents) and Minnesota Mining and Manufacturing Co. (which makes most of the tape). Since the RCA system has come to the fore, neither of these alternatives is being pushed.

Of all cartridge systems, Armour's has the greatest "compatibility"—that is, (a) its tapes could be played on conventional decks, (b) existing tapes could be readily respooled for automatic operation, and (c) present machines could be inexpensively adapted to handle cartridges.

Two plastic leader strips, with wire hooks on their ends, figure prominently in the operation. One is spliced to the end of a cartridge tape, the other is permanently attached to the take-up reel. When you drop a cartridge into playing position, its end is engaged automatically by the take-up hook and started on its way. Trip mechanisms stop, reverse and disconnect a tape.

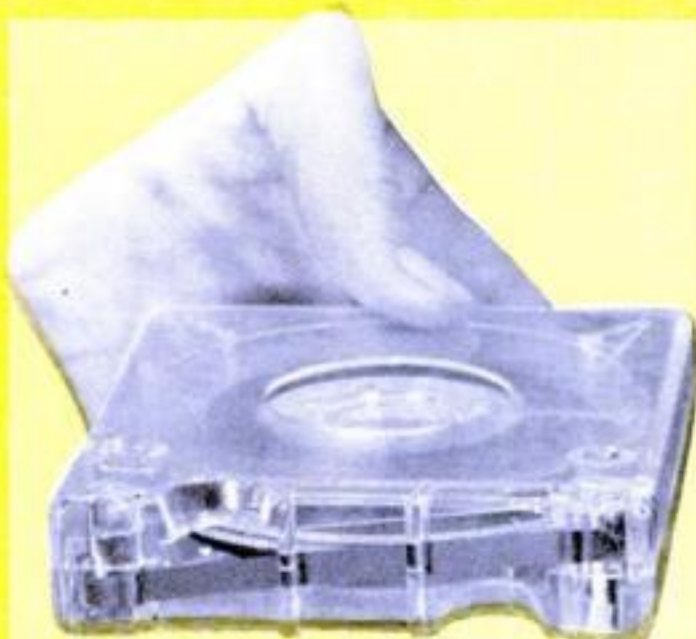


ARMOUR PLAYER spindles cartridge and threads tape automatically when cartridge goes into slot. Reel flanges, thickened to grip plastic leader, keep tape from spilling.

Present lab models would need further development to be marketable.

The 3M cartridge, though more fully developed, has been withdrawn by the company to avoid the confusion of still another recording standard—two tracks at $1\frac{7}{8}$ i.p.s.

Instead of the side-by-side reel hubs favored by RCA, 3M's cartridge uses two complete reels top to bottom. Since they turn with the tape, the reel flanges tend to reduce friction and tape tension. The symmetrical cartridge could be inverted either side up, so tape could be played—or recorded—in either direction. An automatic stop lever (at left in photo below) is similar to RCA's.



3M CARTRIDGE (above) has tape moving through it at slight downward angle. Dropping cartridge onto spindle (right) brings it into playing position.



called for mechanical refinements in the tape transports.

Easier loading. This is a natural outgrowth of longer playing time. Since less tape can now hold more music, it is practical to enclose supply and take-up reels in compact, preloaded, self-threaded cartridges. Several automatic player-cartridge combinations have been devised independently and more or less simultaneously. Because conflicting systems would multiply confusion, the industry seems to have given the nod to the RCA stereo tape and player. To make the machines usable, RCA started issuing cartridge tapes before players reached the stores. Prerecorded releases and blank tapes in cartridge form have also been announced by other companies.

Cartridges, however, are a convenience feature—not an essential ingredient of economical tape stereo. Many hi-fi fans—who can load and thread present reel-to-reel tape recorders with their eyes closed—don't see the necessity of making the job any simpler. They also object to system changes that would make their present tape libraries obsolete.

Some will be unwilling to downgrade the magnificent quality of two-track, 7½-i.p.s. recordings. For in spite of all improvements, lowering tape speed and adding tracks does cause some losses which are measureable, although not necessarily audible.

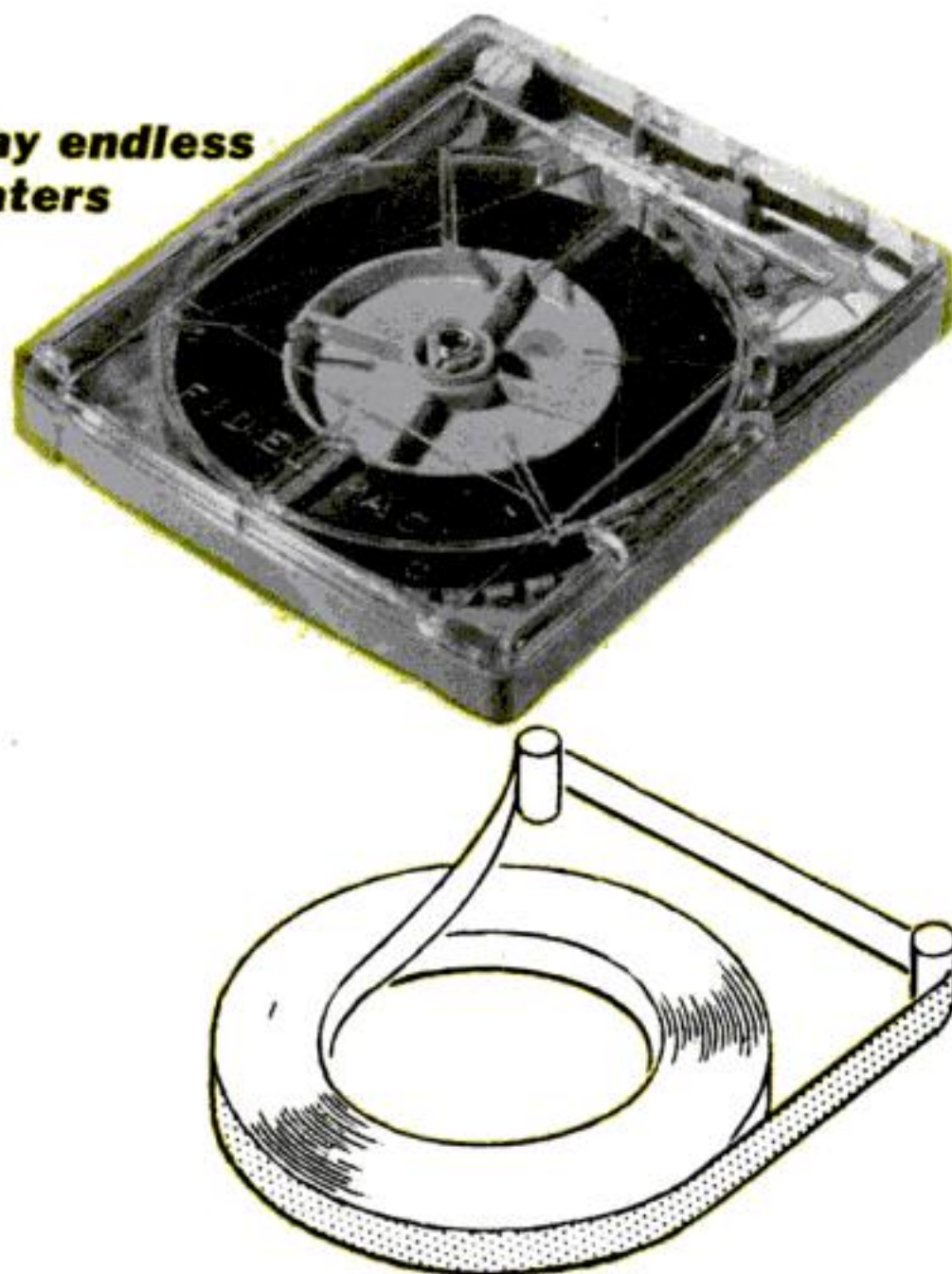
Flexibility. The possibilities in the new reel-to-reel recorders will be considerable. And to round out the picture, you should take note of rumors that reel-to-cartridge adapters are already in the works. With two speeds, two or four tracks, and interchangeability between reels and cartridges, you'll be set for just about anything stereo tapers can throw your way.

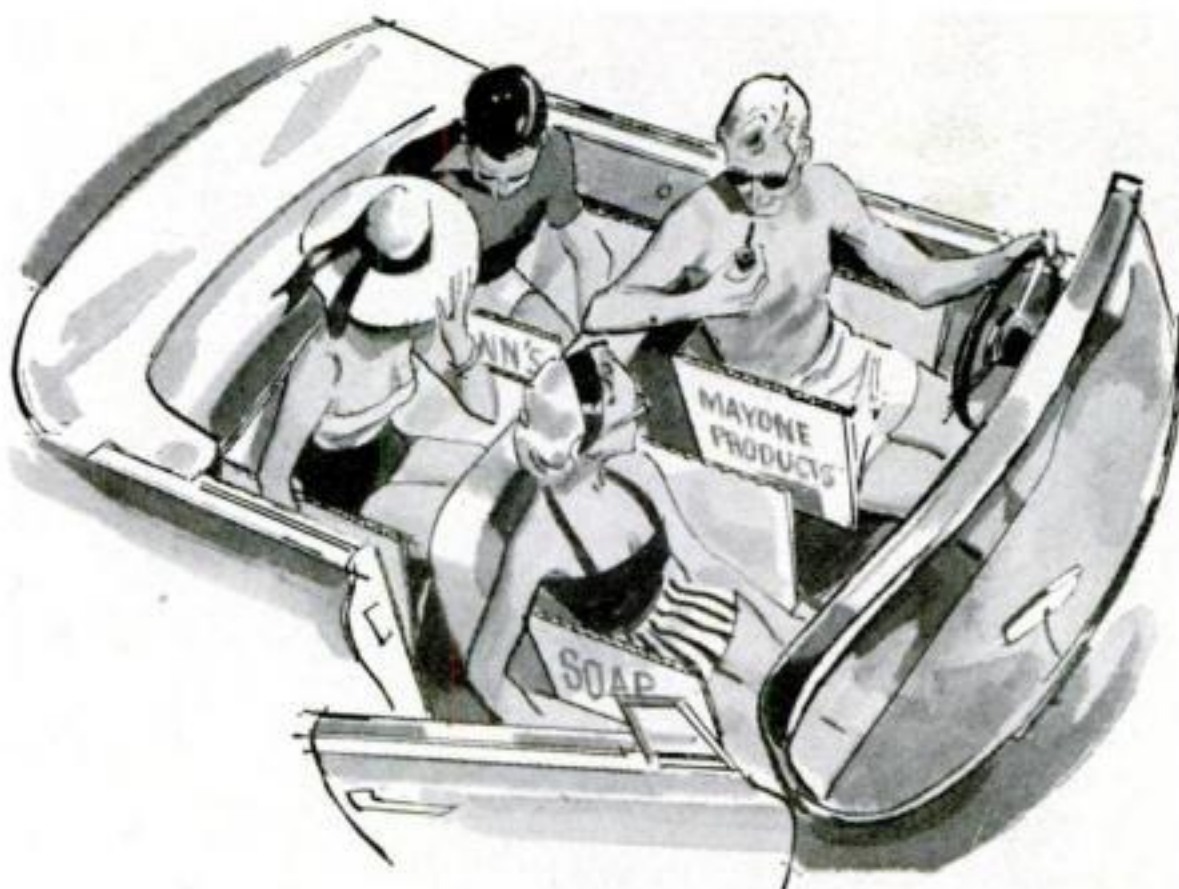
There's no doubt they'll throw plenty—of the best in modern, spaced-out, high-fidelity sound. As the present confusion of speeds, tracks, and reeling methods sorts itself out, it seems probable that long-playing program tapes will be made available in both reels and cartridges. If you like music in your home, it's a safe bet that you'll be adding stereo before long. With tape prices and convenience competitive with discs, the odds are good that you'll add stereo on tape. **END**

Specialty cartridges play endless tapes in message repeaters

ENDLESS-LOOP cartridges of several types are in wide use as commercial message repeaters and for playing background music. They feed tape from the center and rewind it on the outside of a single reel. With tape ends spliced together, a selection will play over and over until the machine is stopped.

Although the machines are relatively simple and inexpensive, endless tapes aren't well suited for average home use. There is no way to back one up and it is difficult to provide a fast forward speed. It starts playing at whatever point it was last stopped.



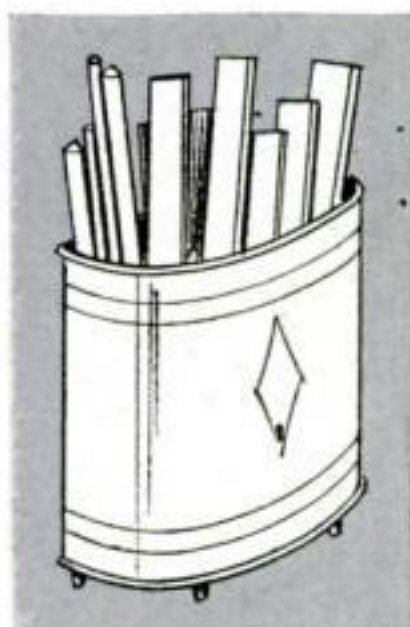


Short Cuts and Tips

FROM PS READERS

Box Seat in Car for After Swims

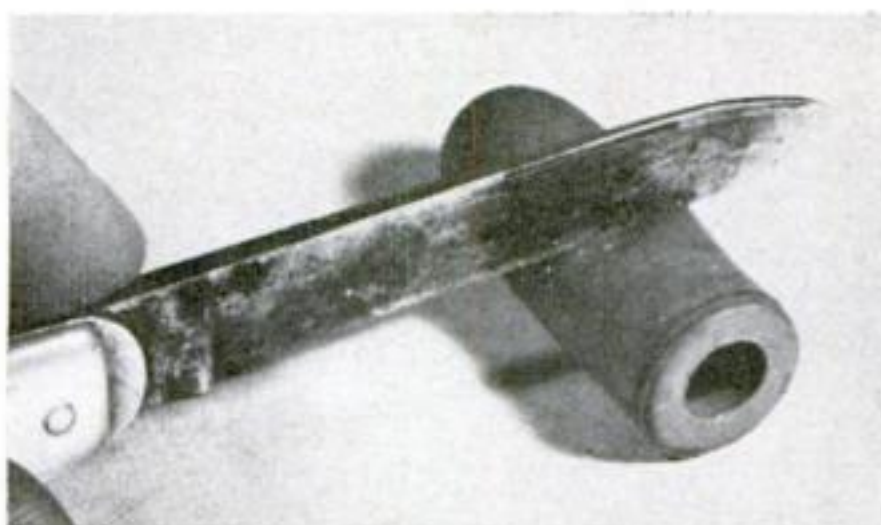
CARDBOARD boxes will keep swimmers in bathing suits from wetting the seats of your car on the way home from the lake. Break away one side of each box and fold it forward to keep cushions and back dry.—*Mark V. Dahl, Minneapolis.*



Hamper Holds Workshop Wood

WHEN my wife bought a new clothes hamper, I put the old one to use in my workshop.

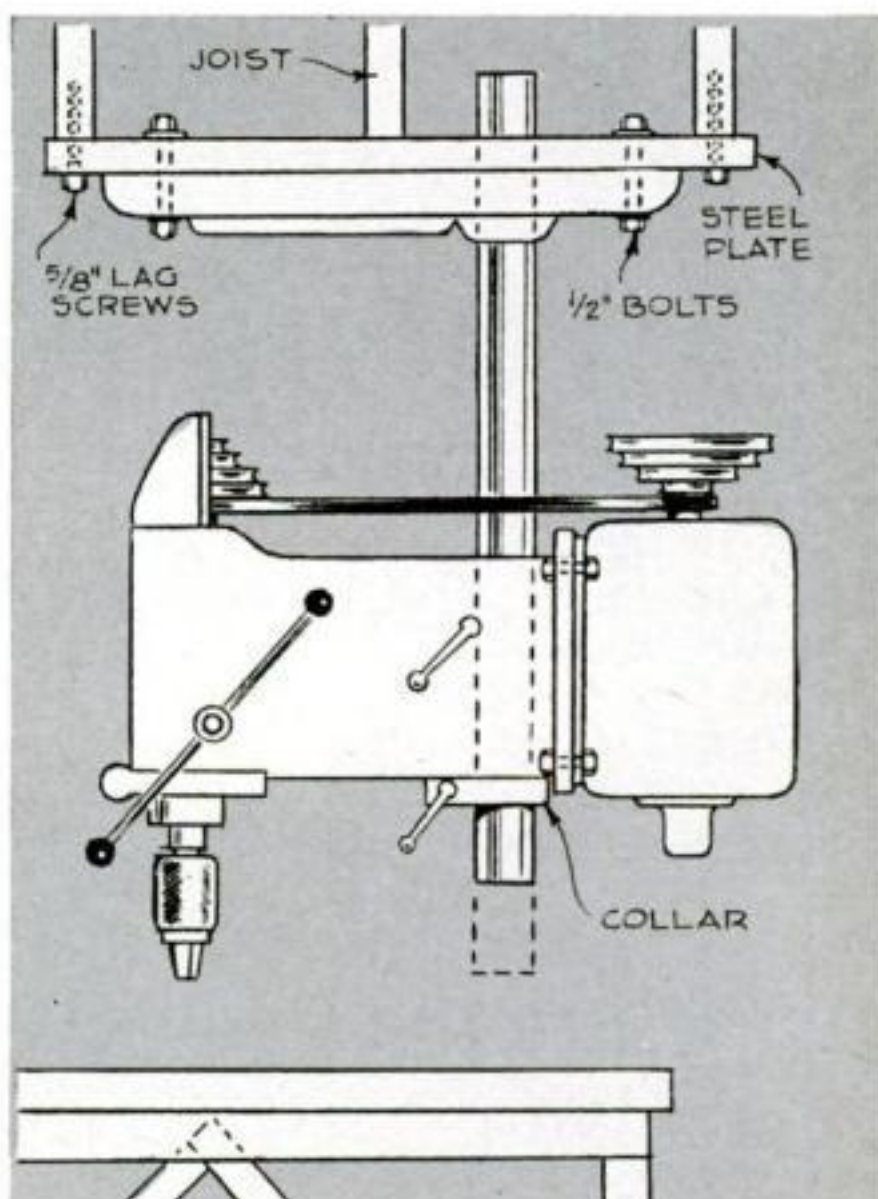
I removed the cover and the hamper now holds leftover wood stock.—*Harold Shanks, Hollis, N.Y.*



Wire-Insulating Grommet

IF YOU need a rubber grommet to insulate a wire passing through sheet metal, you can find one in the bathroom medicine cabinet. Just cut a suitable section from the bulb of a medicine dropper.—*T. C. Van Alstyne, Don Mills, Ont.*

▶▶▶TO MAKE a good seal between the outlet of a downspout and the drainage-tile line, try stuffing oakum in the joint. It's easy—you can put it in with a knife.—*Harry H. Powell, Akron, Ohio.*



Overhead Drill Press

TO ENLARGE the throat of my drill press, I mounted the base on the ceiling joists, discarded the old table, inverted the head on the column and added a safety collar to keep it from dropping to the floor. Then I anchored a solid bench underneath. Now, instead of a 7" throat, I have one as wide as the basement itself.

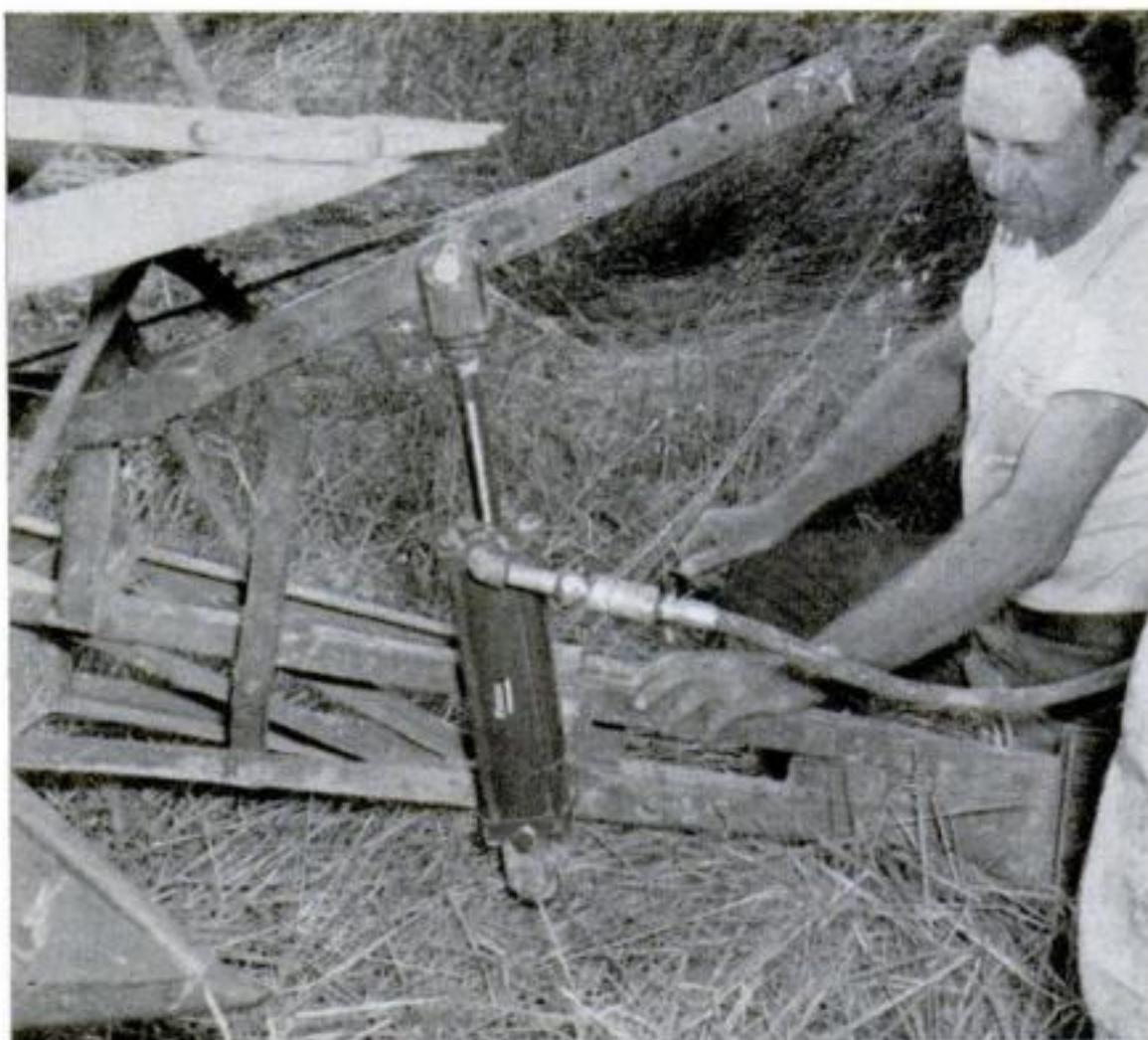
Two things I had to be cautious about to drill true holes: I had to be sure the bench was level and the drill press plumb.—*Cecil D. Richards, Wheeling, W. Va.*

Short Cuts and Tips

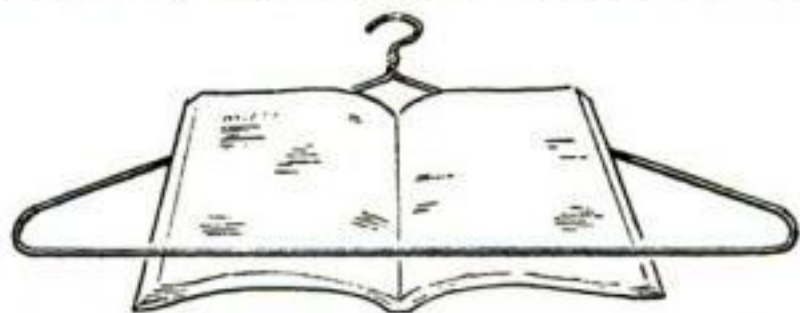
FROM PS READERS

Taking the Work Out of Reaping

A NEIGHBORING farmer mounted a hydraulic cylinder on his combine to raise and lower the cutter bar so he wouldn't have to do it by hand. The cylinder is mounted on the combine tongue with its shaft coupled to the lever that actuates the raising or lowering of the cutter bar.—*John Krill, North Lima, Ohio.*



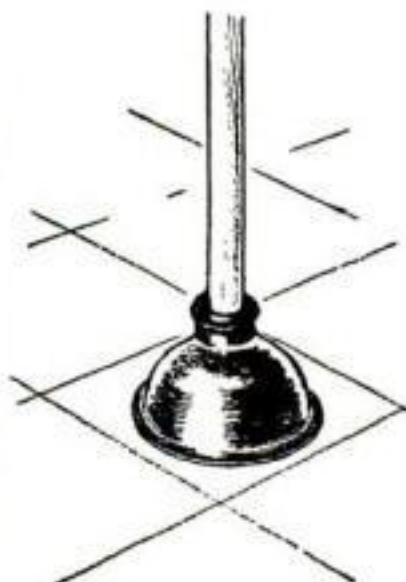
Keeping Reference Book Open



IF YOU find that a book or magazine won't stay open at the page from which you are following directions for a shop project, try keeping it flat with a wire coat hanger. Slip the opened book through the hanger with the hook at the back.—*John Lodi, Springfield, Mass.*

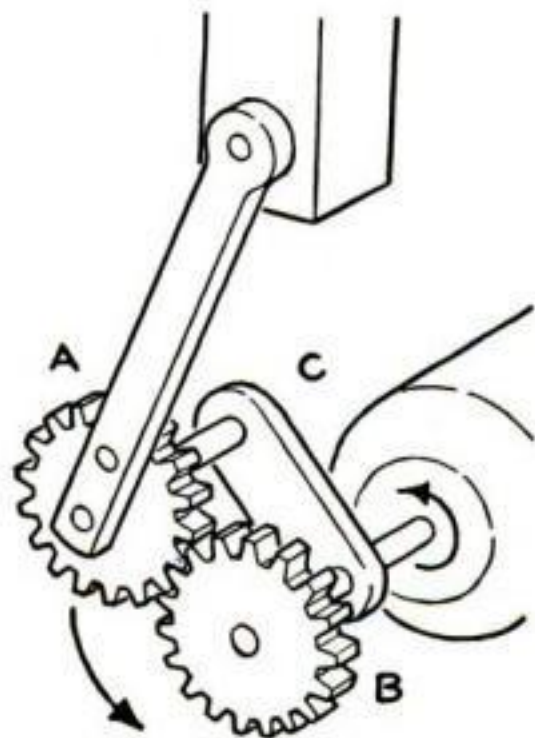
Locating Loose Floor Tiles

IT IS sometimes difficult to tell whether floor tiles are loose or properly cemented down. I use a sink-drain force cup. When it's pressed down and pulled up again, a loose tile will be revealed quickly.—*Victor H. Lamoy, Upper Jay, N.Y.*



Answer to the Double-Speed Crank Problem

[on page 148]



MIKE used the sun-and-planet motion, a type of epicyclic gearing devised by James Watt for the steam engine when a patent prevented him from employing the crank. Gear A is fixed on the end of the connecting rod and cannot turn. Gear B is keyed to the shaft. Link C, which turns on the shaft, maintains the center-to-center distance of both gears and so keeps them in mesh.

As A swings around B once, B makes two complete turns (or, conversely, B must make two turns to drive A and the con rod around it once). Why? Because in traveling around B, A also makes one turn *in relation* to B. This relative rotation adds its effect to the total movement of B. To look at it another way, the center of gear A describes a circle of twice the radius of gear B, which must therefore turn twice as fast.

Pointers About Floor Finishes

PICKING the right finish for wood floors is not as simple as it once was. In the old days you went to the hardware or paint store, bought some shellac or paint—and that was it.

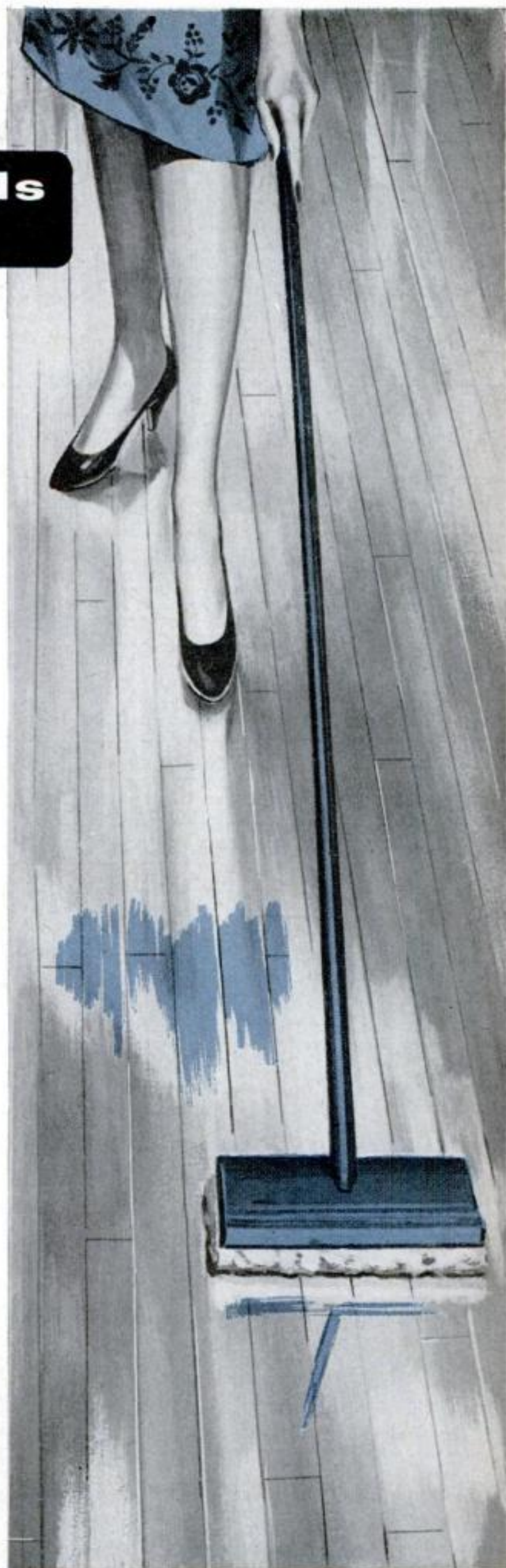
No longer. You have your pick of so many products that the only way to make a wise choice is to know, beforehand, what your requirements are, and which of several standard floor-finishing systems will come closest to meeting them.

To be good, a finish should seal out dirt and grease, resist stains and be reasonably easy to patch. It should not scratch, chip or flake off, require excessive care or change color materially.

Basically, you have two types of material to choose from: *penetrating seals* and *surface finishes*, the latter including shellac, varnishes and other synthetic coatings.

Penetrating seals. These are actually thin varnishes, made with slow-drying oils or with specially controlled drying properties that allow them to work well down into your floors. There they bind with the wood fibers, locking them together. Thus they may help to improve the wearing qualities of a soft wood like pine.

On hardwoods, a seal of good quality,



BEFORE YOU APPLY ANY FINISH, weigh all factors, from ease of application to durability.

5 Points to Consider in Choosing a Finish

1 APPEARANCE. Want a high gloss, "soft satin," or something in between?



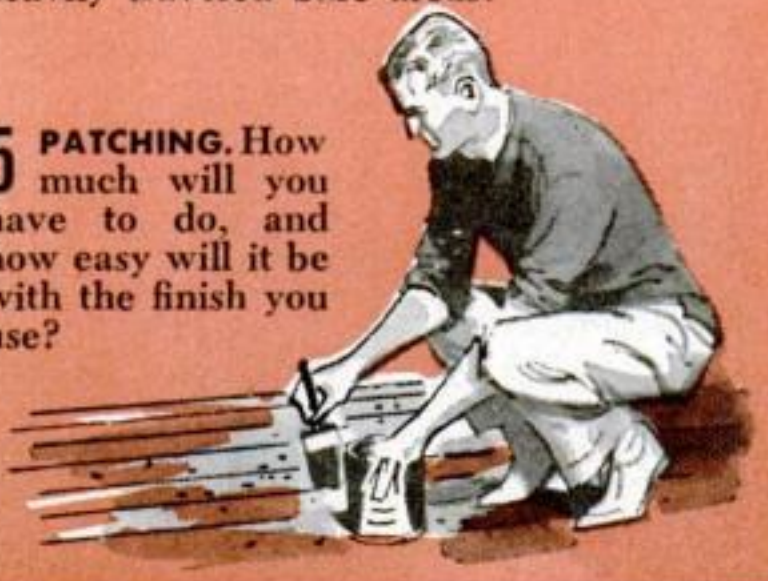
2 COST. How much are you willing to lay out? Finishes vary greatly in price, and a bargain product may indicate stinting on important ingredients. On the other hand, you may not need the toughest, most expensive finish.

3 TIME. How long can you spend finishing your floors? Do you expect to do a speed job in a single day? Or are you prepared to take at least two days and allow another one for thorough drying?



4 TRAFFIC. Are your floors well covered with carpets? Or are there large and heavily traveled bare areas?

5 PATCHING. How much will you have to do, and how easy will it be with the finish you use?



covered by a high-grade wax (paste or solvent-based liquid) gives you a floor that is almost indestructible. In appearance, it has a modest gloss instead of a mirror shine.

Penetrating seal is easy to apply—you slosh it on with a soft applicator, allow it to soak in for about 20 minutes, then wipe off the excess carefully. Routine maintenance consists of regular waxing to keep a good protective coat on the surface. When accumulated wax becomes dirty, as it almost certainly will over a period of four or five years, it should be stripped off and a new coat applied.

Since it's *in* the wood, the seal cannot chip or flake off and scratching and marring are negligible. With some seals your floors retain a bright, natural wood tone. Others produce a richer color.

Falling loosely into the penetrating-seal class are several products that are a combination of varnish and wax. More accurately, these are *penetrating stain-wax* materials. They come both clear and in colors as deep as dark walnut.

Surface finishes. These have some penetrating power, but depend primarily upon their ability to adhere directly to the floor surface.

● **Shellac.** This is the oldest, cheapest and fastest drying. It gives a fine high gloss that can be reduced, if you want, by steel-wooling.

Shellac makers maintain stoutly that high-quality shellac is every bit as tough as other finishes. Others will tell you just as emphatically that shellac isn't as abrasion-resistant as varnish or other synthetic coatings.

The fact remains that vast quantities of shellac are used on floors. It dries tack-free in minutes, and its fumes are harmless.

To get the best results, always check the date on the label to be sure the shellac you buy is not more than six months old. Choose a four- or five-pound

Characteristics of Floor Finishes

		PENETRATING SEAL	SURFACE COATINGS		
			Shellac	Varnish	Other Synthetics
SURFACE APPEARANCE		Low gloss	Satin to high gloss*	Very high gloss* except for new satins, which may not be quite so durable	Low gloss to very high gloss (check label)*
COLOR		Clear or amber (check label)	Light, with white shellac. For a warmer, darker tone add stain, or use orange shellac	Mellow, although newer varnishes tend to stay quite light	Generally colorless or very light
RELATIVE COST		About the same as varnish	Least expensive	Usually a little more than shellac	Ranges from a bit more than varnish to twice as much
COVERAGE —ONE GALLON	1ST COAT	Depends on wood. Figure on approximately 200 sq. ft.			
	2ND COAT	500-700 sq. ft., depending on wood	400 sq. ft.	500-700 sq. ft., depending on wood	300-600 sq. ft., depending on wood
COATS NEEDED FOR BEST JOB ON BUSY FLOORS		2 on most hardwoods; 3 on mahogany, walnut or pine, to avoid unevenness	3, except on oak, where 2 may do	2 or 3, depending on wood	
CAN BE APPLIED OVER		Bare wood only	Bare wood and shellac	Bare wood, varnish; possibly shellac (check label)	Bare wood. Usually can't be used over other finishes (check label)
REDUCER		Normally mineral spirits, turps or reducer (check label)	Denatured alcohol	Turps, mineral spirits or special solvents. Don't use benzine (dangerous)	Many different solvents. Follow label instructions closely
IS WAX NEEDED?**		Advisable to use liquid or paste wax. (Exception: Sealers are sometimes surfaced with varnishes or resin plastics)	Recommended for heavy traffic areas, unless you plan to retouch with shellac at intervals	Recommended	Not needed, but prolongs life
REGULAR MAINTENANCE, IF WAXED		Buff regularly. Rewax heavy traffic areas at from weekly to monthly intervals, as needed. Wax unused areas around rugs twice a year			Buff occasionally. Avoid over-waxing, to prevent slippery floors
HOW CLEANED, IF NOT WAXED		Go over with a damp mop, or sparingly with soap and water	Once a year wash with a commercial cleaner, then apply a thin, fresh coat	Same as penetrating seal	
HOW CLEANED, IF WAXED		Strip dirty wax or excessive buildup with remover and rewax			

NOTES: *Gloss can be reduced, with all finishes, by light steel-wooling after the final coat is thoroughly dry.
 **After finishing or refinishing a floor with penetrating seal, varnish or other synthetics, wait at least two weeks before applying wax. Otherwise it may damage the finish through solvent action. Let shellac dry a week before using a waxing machine, to prevent softening through friction heat.

"cut" and reduce it, one part to one, with denatured alcohol. Keep it in a tightly sealed glass jar—if stored in a metal container, it may darken.

Apply shellac only on dry days, as moisture can cause clouding. Use three coats, brushed on at 24-hour intervals. Allow the last coat to dry a full day. Waxing greatly extends the life of a shellacked floor, and prevents water stains. With unwaxed floors, wipe up immediately any water spilled or tracked on them.

Shellac is easier to patch than varnish. If it is not worn down to bare wood, a light sanding is enough preparation for a new coat. In badly scuffed spots, strip off all shellac before recoating.

● *Varnishes.* These come in all grades, and the best of them give an extremely fine floor finish. You have your pick of these types: spar, alkyd-resin, and oil-modified epoxy. All are very durable, and gloss is generally high. (Again the sheen can be reduced, if you wish, by steel-wooling.) The spars—also known as "orthodox"—are a mixture of gum and an oil, heated together. The alkyd-resins, developed since 1930, are related to auto enamels, and the oil-modified epoxys resemble the new grease-and-soap-resistant enamels used for washing machines and refrigerators.

Varnish is easy to apply, but usually hardens more slowly than shellac. Some manufacturers advertise speed varnishes that "dry" in as little as four hours, or are "tack-free" in 60 minutes. Don't confuse these claims with "hardening" time, which is a great deal longer.

As with shellac, it's best to put on several thin coats and let them harden for at least 24 hours. Men who test finishes for the Maple Flooring Manufacturers Association stress this. Another expert, Arthur Egner, of the New York Wood-

finishing Supply Co., says: "It's the only way to get durability and a really fine shine." And from a third industry technician comes this: "I wouldn't think of letting a coat of *anything* dry less than a full week on my floors."

If you are rushed, you can save time by using shellac for your first coat under some varnishes. This also saves a little money. Further, shellac has the virtue of raising any loose grains and hardening them so they can be leveled with sanding. A word of caution, though: Check the label: not all kinds of varnish can be applied over shellac.

Varnish holds up much longer under wax. But even when unwaxed it resists water, alcohol and acid stains. It gives wood a pleasant, mellow tone, but some varnishes (especially the cheaper grades) tend to darken after a time.

● *Other synthetic coatings.* These are usually lacquers, and are commonly thought of as "bowling-alley" finishes. Lacquers are deposited on your floors by the evaporation of a solvent, whereas

varnishes actually undergo a slow chemical change during drying. Lacquers give a hard, glossy finish, but the sheen is generally not as high as that of shellac or varnish unless you apply several coats. Some are harder to lay on than varnish, because the solvents evaporate so fast you have little time to smooth out brush irregularities.

Hard as they are—they're also highly impervious to water, acid and dirt—the best lacquers will eventually show scratches in heavy wear areas. For this reason waxing is a good idea, despite the claims of some manufacturers that their products don't need it.

There's some disagreement about the ease of patching lacquer coatings—new areas may look lighter because the old coat almost always darkens somewhat.

WHEN Bill was given a used mower engine, he mounted it on his old 24" bike. A 1" rubber friction sleeve on the engine shaft drove directly against the rear tire.

It worked, but top speed was low. Offered a swap for a light racer with 28" wheels, Bill took it, knowing that at the same r.p.m. the bigger wheel would travel farther. But to his great disappointment, the top speed obtainable was exactly the same.

...How Come?

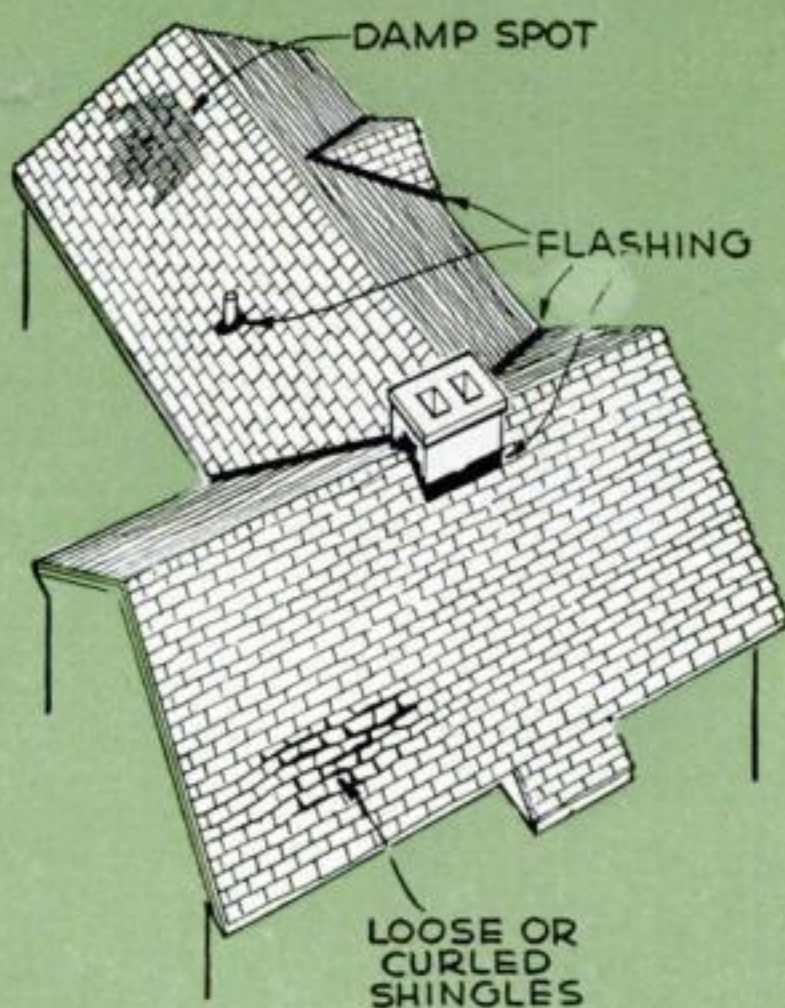
ANSWER: The lower ratio between the 28" wheel and the ground was exactly offset by the higher ratio between tire and drive sleeve. To change the overall ratio, Bill needed a bigger sleeve on the engine shaft.

Roof Leaks

fix-it file

BEST TIME TO TRACK DOWN LEAKS is usually during a rainfall. First look for dampness and discoloration on the underside of roofing boards and rafters. Then trace it to its point of entry—this may be a porous area rather than a hole. Drive a nail upward at the spot so you can locate it from outside and make repairs.

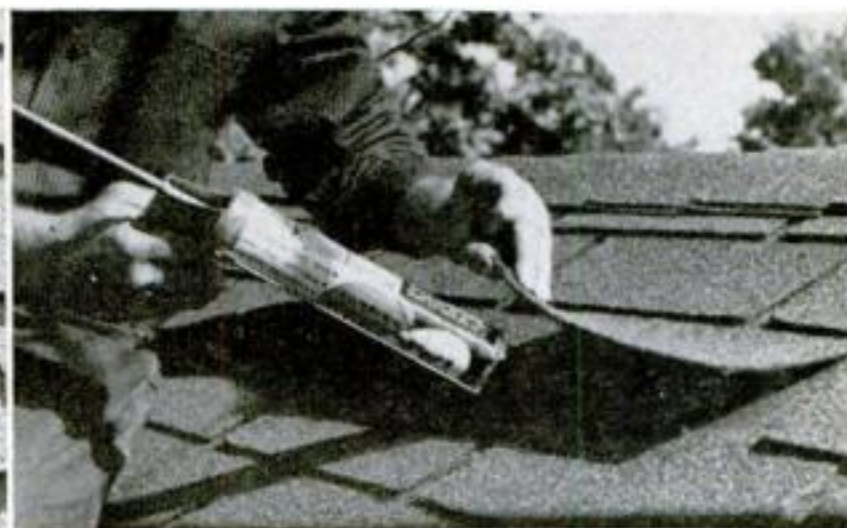
When a finished attic or a flat roof without a crawl space makes underside checking impossible, inspect from the outside. Start at a point over the wet spot in the ceiling and keep widening the search. Look for a loose or bulging shingle; an unexplained damp spot in an otherwise dry roof; and rusted-through metal and gaps in roofing cement in valleys and other flashing around chimneys, dormers, vents and soil stacks.



How to stop leaks in shingled areas



RAISED SHINGLES are vulnerable to wind-whipped rain. The bumps are caused either by curling or nails that missed the rafters and backed out during summer heat. Remove



raised nails and seal the holes with calking. Lift each shingle again, squeeze a dab of roofing cement the size of a 50¢ piece underneath, and press the shingle down.



SLOW LEAKS may be caused by nails that are exposed to the weather and rusted or loose, as on ridges. Pull out loose nails, calk and replace them. Cement over rusted ones.



USE TABS OF GALVANIZED IRON to mend leaky shingles that are otherwise in good shape. Cover one side with cement and push tab, coated side up, under the shingle.

How to replace a shingle



1 LIFT THE SHINGLE ABOVE IT, gently, and remove nails that hold the one to be replaced with a screwdriver or wrecking bar. Pick a warm day, when shingles are flexible.



2 SLIP OUT DAMAGED SHINGLE, carefully. If it is of the tab type, use tin snips to free it from the remainder of the strip. At the same time, remove fragments and dirt.



3 SLIDE NEW SHINGLE IN PLACE. (Cut one from a tab strip, for uniformity, if you're working with that type of roof.) Align it with the shingles to the right and left of it.



4 RAISE SHINGLE ABOVE IT, once more, while you nail down the new one. If you've loosened the nails holding the upper shingle, drive them firmly back in place.

What to do about flashing



CEMENT LOOSE EDGES DOWN to patch either rolled roofing or metal valley flashing. If overlapping shingles leak, slide cement-coated galvanized sheets under them. Apply a lapping coat of cement to adjacent areas.



RENEW LEAKING FLASHING around a vent stack, chimney, dormer or skylight. First break out loose and cracked calking; then apply plenty of new cement. You'll find that a putty knife makes a good applicator.

How to Upholster a Chair Seat

A GOOD reupholstering job takes more care than skill. When stripping off the old materials, note carefully how they were applied. This goes for the method of attaching the fabric, corner-folding and tacking technique, and braid or other trim details. Under the fabric, see where the webbing was anchored to the frame.

For tools you need a webbing stretcher, one or more tack pullers and, if you like, a handy magnetic tack hammer.

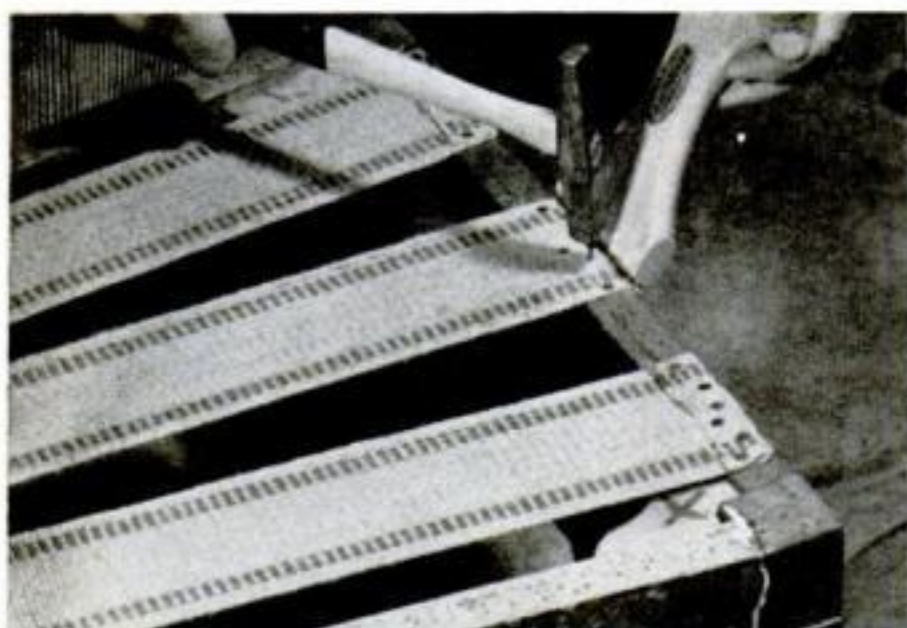
Materials depend upon the job. But in general you'll want webbing; small, medium and large tacks; casein glue; muslin for an undercover; dark-colored scrim for a bottom cover; seat fabric; and "gimp" or other decorative braid. To see how it's done, turn the page.



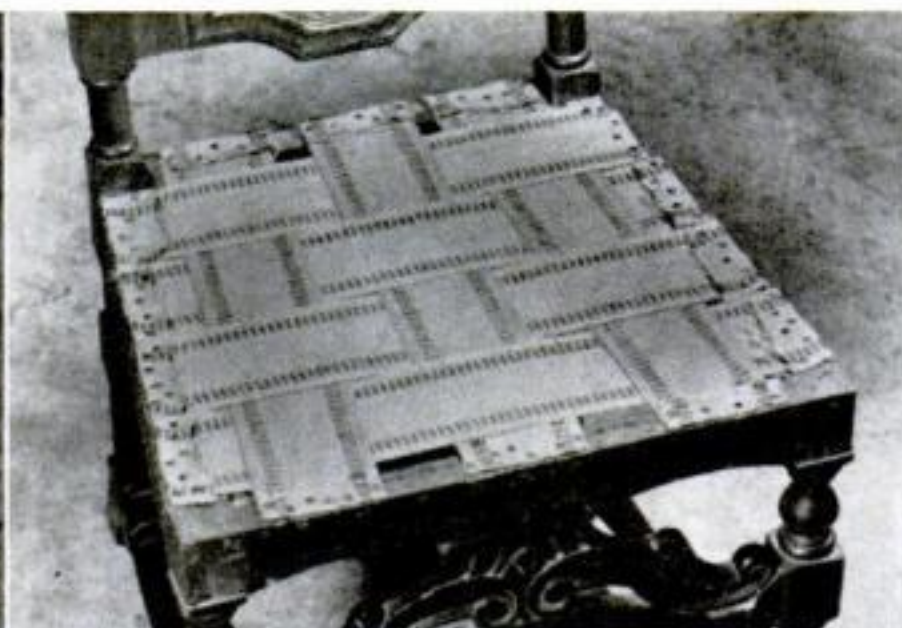
CHAIR FRAME, below, has been stripped of cover, padding, webbing and tacks. This is the time to reglue loose joints and build out chipped areas with wood putty, matching the finish.



Webbing must be taut and well-secured



1. ATTACH WEBBING STRIPS to top of rear frame member with five tacks apiece, leaving an overhang. Double overhang back and secure with five longer tacks. Bring strips forward, lever them taut with stretcher, and tack as shown. Again, double ends back and tack down.



2. APPLY CROSS WEBBING the same way, weaving it over and under the front-to-back strips. The whole webbing structure should be drum-taut. Upholstery tacks used in the chair shown are numbers 10 and 14. Doubling strip ends increases strength and prevents raveling.



3. MAKING THE PAD ROLL: Apply this to prevent wear of covering fabric on sharp chair edges. Use sash cord or any moderately soft rolled material as a filler, folding it inside stand-



ard webbing. To put it on, align the roll with the chair edge and drive tacks into the frame just behind the filler. Space them at approximate 2" intervals to prevent shifting of pad.

Here's how the pros put on the cover fabric



8. PLACE FABRIC so pattern is aligned with seat. Draw material around the forward edge of frame and tack it to the underside. Then pull it back tightly and tack at rear. Next, tack the sides—again under tension. The first tacking should stop about 5" from each corner.



9. LEAVING UNTACKED SECTIONS allows for fitting and trimming. Snip a small square out of the fabric at each front corner to reduce bulk. Then make neat "inside miter" folds, as shown. Fabric on the seat side should overlie the material brought around from the front.

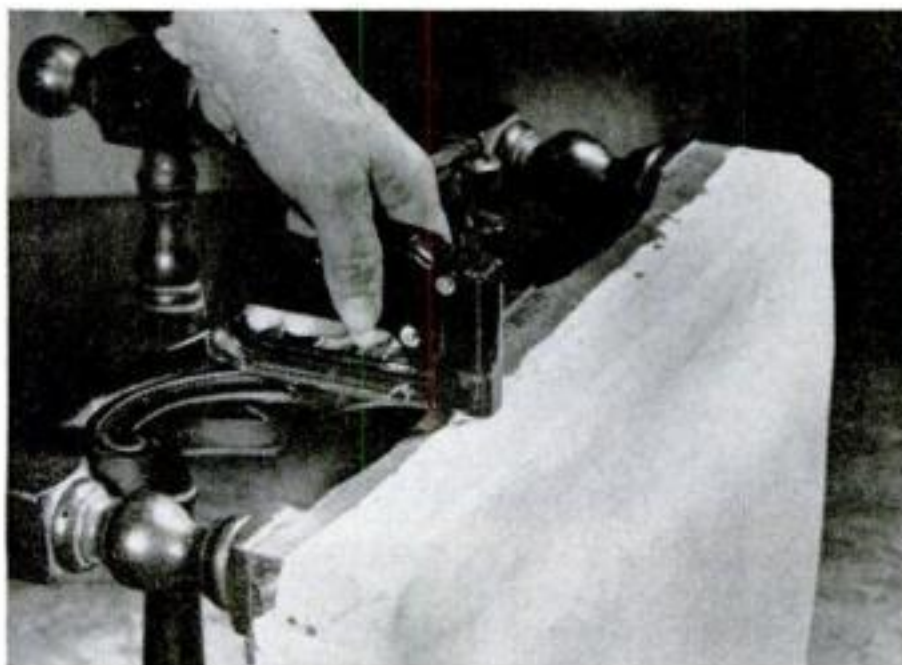
Muslin covering rumple-proofs the padding



4. **USE HORSEHAIR**, cotton or any other furniture-padding material (usually there's enough of it under the upholstery that has been removed). Spread it evenly over the new webbing.



5. **UNDERCOVER**, of unbleached muslin, holds padding well in place. Draw it over the sides of the chair frame and attach it with small tacks or staples, without folding in the edges.



6. **STAPLING GUN** is a time-saving tool for this job, can also be used, later on, to apply the bottom covering. Here, staples offer an adequate grip, because the fabric is under little stress.

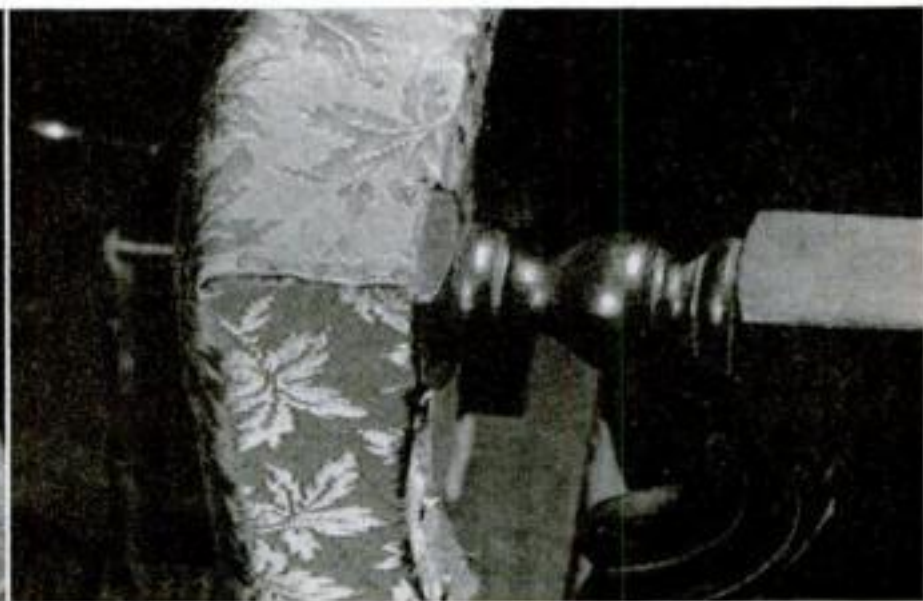


7. **NEATLY JACKETED NOW**, the padding won't shift while you're working with the cover fabric. Note triangular folds that gather in surplus muslin at the forward corners of the frame.

... starting at the front of the chair frame



10. **SECURE FOLD** with gimp tacks when you're sure it is right—smooth, with the fold line vertical. At corners, where the legs meet the frame, shear away excess material flush with the line of the seat bottom. Don't worry about the cut edge showing; gimp will conceal it later.



11. **FINISHED FORWARD CORNERS** should look like this one. The remainder of the material to be fastened to the seat bottom has been snugged down and tacked in place, then cut flush with inner edge of framing. Note tack spacing—1" apart. *[Please turn the page.]*

How to handle rear corners, bottom covering and gimp



12. CUT SQUARES, a bit too small to accommodate legs, out of corners of the fabric. Fold enough material inward and back to produce a trim fit and secure it to the framing with tacks.



13. ATTACH GIMP with clear casein glue and just enough gimp tacks to hold strip while glue sets. Gimp runs around lower edge of frame, up and around rear legs at edge of fabric.



14. STAPLE OR TACK BOTTOM COVER to chair frame with folded-back edges about $\frac{1}{2}$ " in from gimp. Material should be reasonably taut, but it is not subjected to tension when in use.



15. THE FINISHED CHAIR SEAT: Here's what it should look like: taut, neat, and ready for years of service. Gimp tacks are barely visible.



Short Cuts and Tips

FROM PS READERS

Weather Protection for Group Mailboxes

MAILBOXES for homes at California beach resorts are usually grouped at the corners to make it easier for the mailman.

This arrangement also protects them from rain. Pigeonholes are enclosed in a plywood box, set on two-by-six uprights and roofed with $\frac{3}{4}$ " boards.—*Hi Sibley, Nuevo, Cal.*

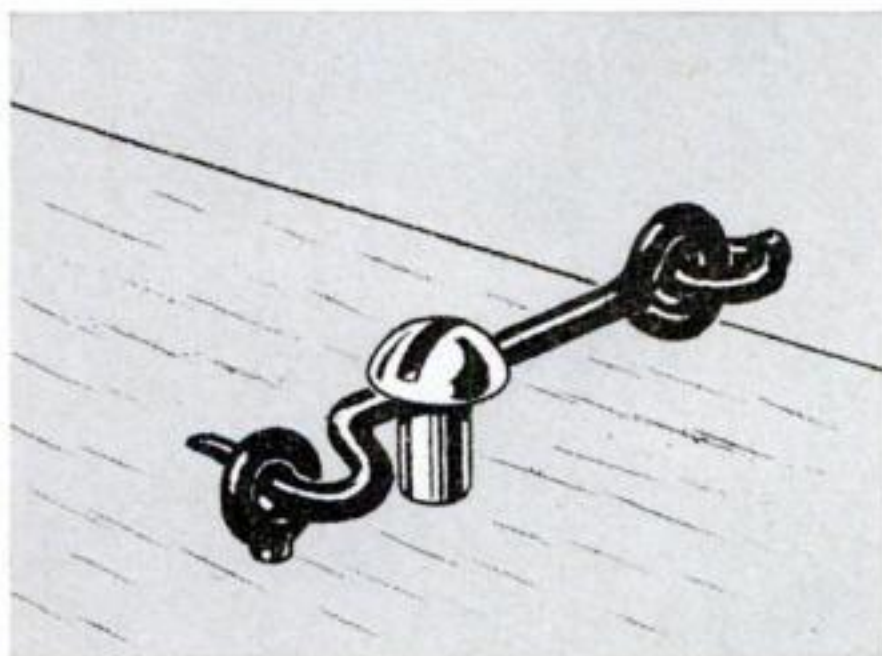
Easy Way to Loosen Wallpaper



You can loosen stubborn patches of wallpaper, aided by a plumber's suction cup. First moisten the paper well and then press the cup over it and pump repeatedly.—*Donald Edwards, NYC.*

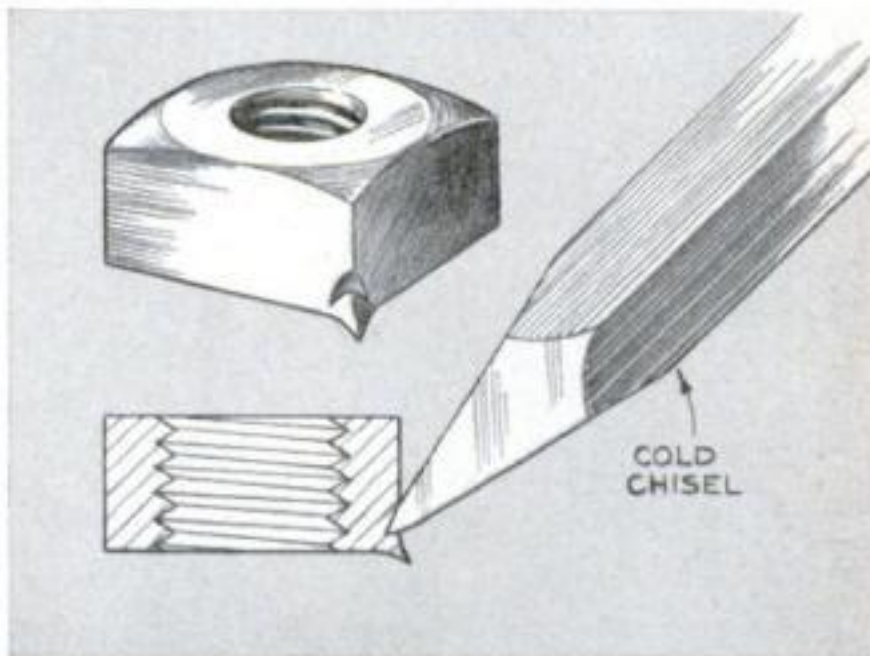
Emergency Hardwood Plugs

PLUGGING a $\frac{1}{2}$ " hole is simple if you have a round, wooden clothespin handy. Cut a slice to fit the hole's depth, beginning about 1" from the top of the pin.—*John Mihalick, East Liverpool, Ohio.*



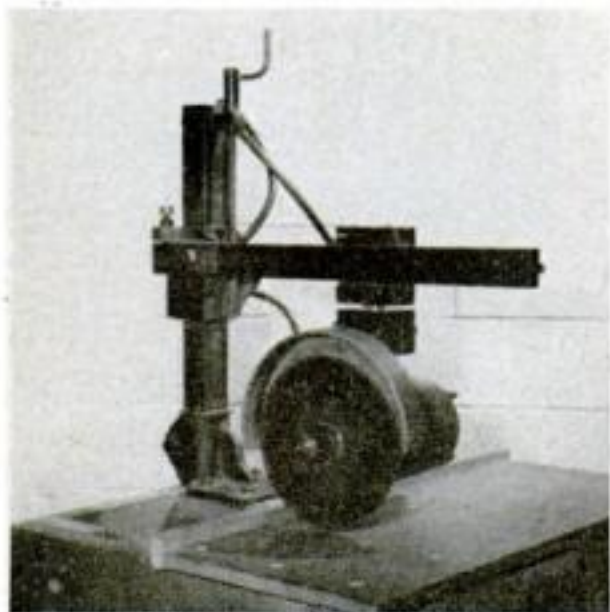
Window-Screen Safety Catch

TO PROTECT children from the danger of opening a window screen and possibly falling out, I place a screw in the sill near the hook. Then they can't unhook it. When the screen needs to be opened, the screw can be removed with a screwdriver.—*Marie T. Gadd, Park Ridge, N. J.*



Tightening Hard-to-Get-At Nut

TO TIGHTEN a bolt that has its nut in a place where you can't use a wrench to hold it, upset one or two corners of the nut so it will bite into the work when you run it up with your fingers. Then it won't turn when you tighten the bolt head.—*R. L. Clough Jr., Bristol, N. H.*



FIRST RADIAL-ARM SAW was built in 1922 by Raymond E. DeWalt. Early production models were known as the "Wonder Worker."

Oldest Radial Saw Gets Newest Look

Completely redesigned, this 37-year-old saw has a drop-leaf table and a quick-stop brake

YOU won't see the familiar green radial-arm saw made by DeWalt any more. In its place at your dealer's you'll find a new model—light blue with a tinge of green—completely redesigned and incorporating an impressive number of new features.

The new Model 925 (9" blade, 2.5" cut) has a totally enclosed two-hp. motor with a flat bottom for maximum clearance over the work. An automatic electro-mechanical brake (standard equipment) stops the blade five seconds after the motor is shut off. The cutting table is

made of Weldwood Lebanex, developed by U. S. Plywood. It's a resin-impregnated laminated board said to be warp-free and resistant to dents and abrasion.

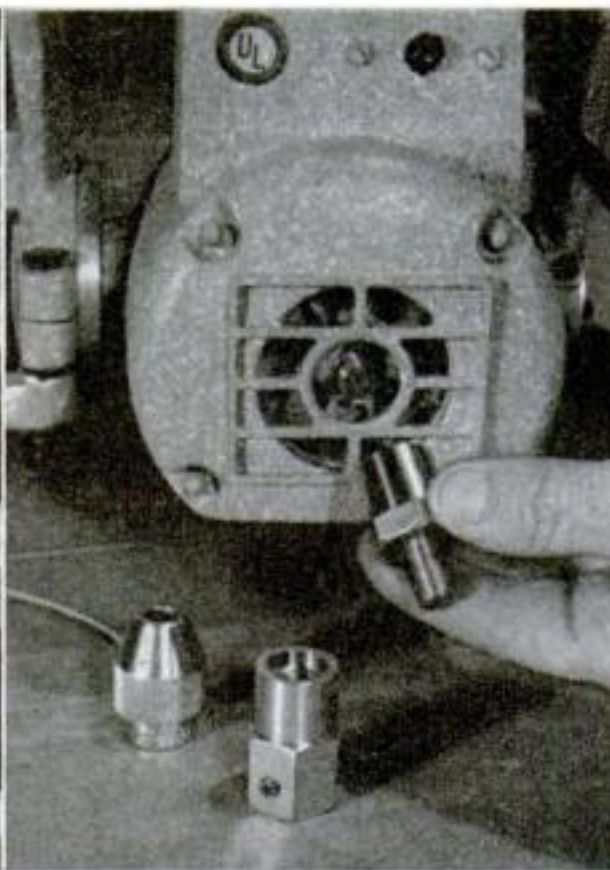
The saw will make a 25"-wide rip cut—it rips a 4'-by-8' panel down the middle with an inch to spare—and crosscuts a 21" board. The swing of the overarm permits miter cuts to 10".

The new model has not increased in price, which remains at \$239. The lathe, jointer and saber-saw attachments, sold with the previous model, have been color-styled to match the 925.

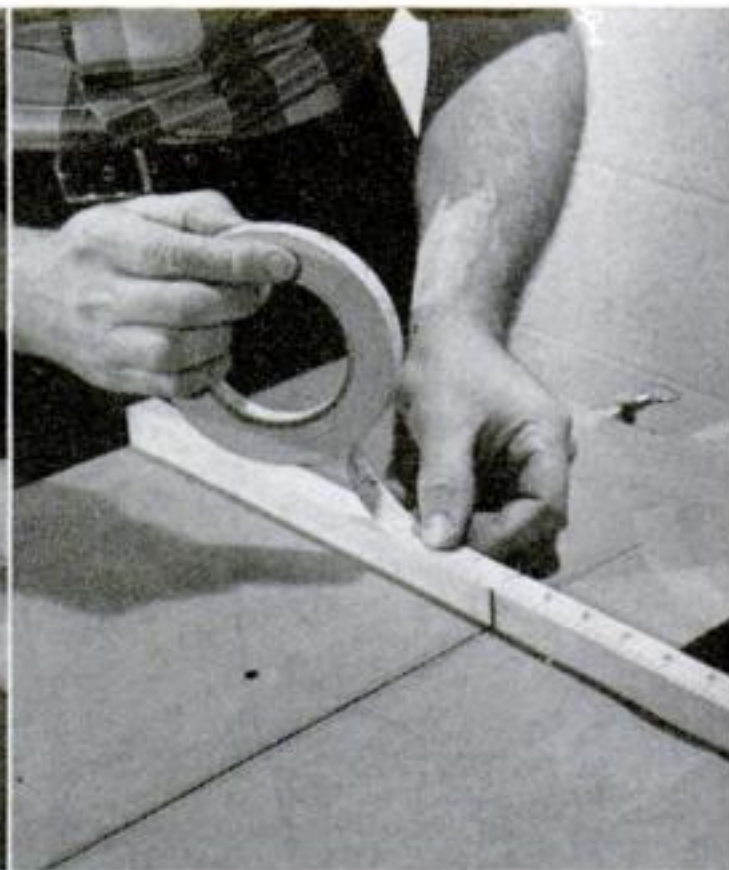
These little engineering tricks make the saw safer



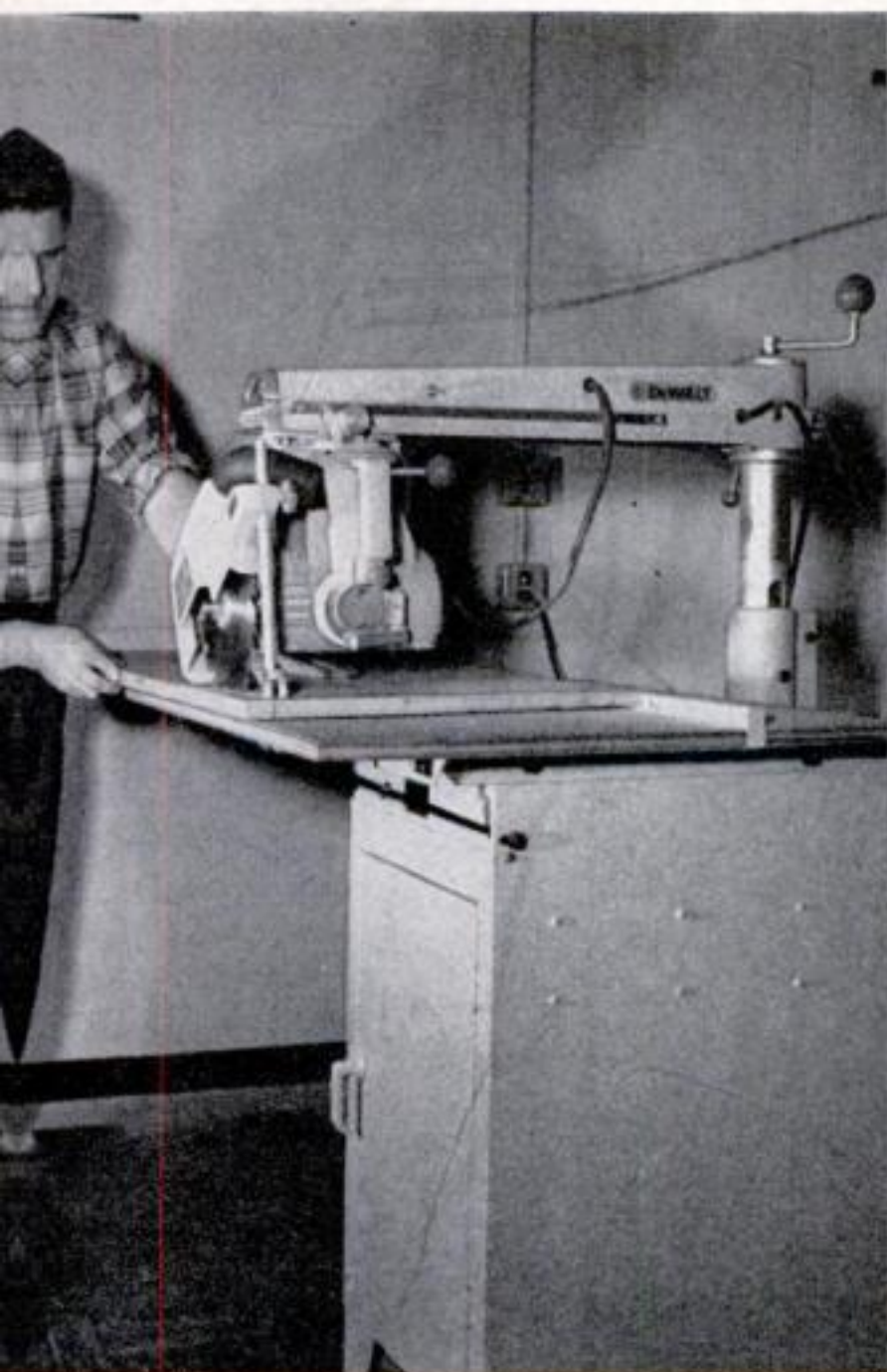
NEW SWITCH KEY is a strong casting that won't break off if bumped with a board. It has a grooved shank that prevents it from being removed from the switch while the motor's on.



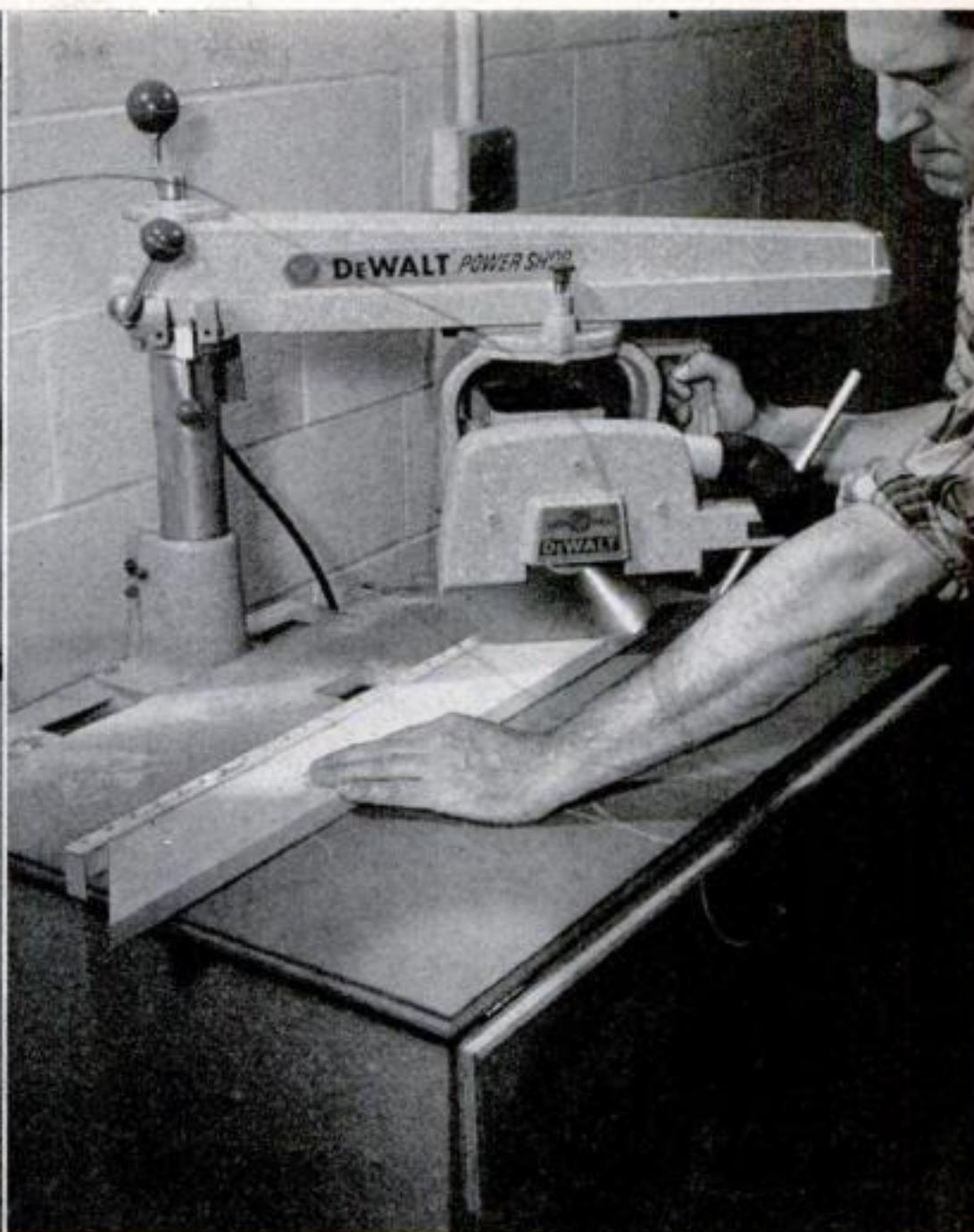
BORING AND ROUTING TOOLS can be driven by a rear motor shaft that is enclosed for safety. A Jacobs chuck or a special adapter for 1/4"-shank bits screws onto the threaded shaft.



EXPENDABLE CUT-OFF SCALE. When the fence is cut through to the point of replacement, a new one can be made and this specially printed pressure-sensitive tape stuck on over it.

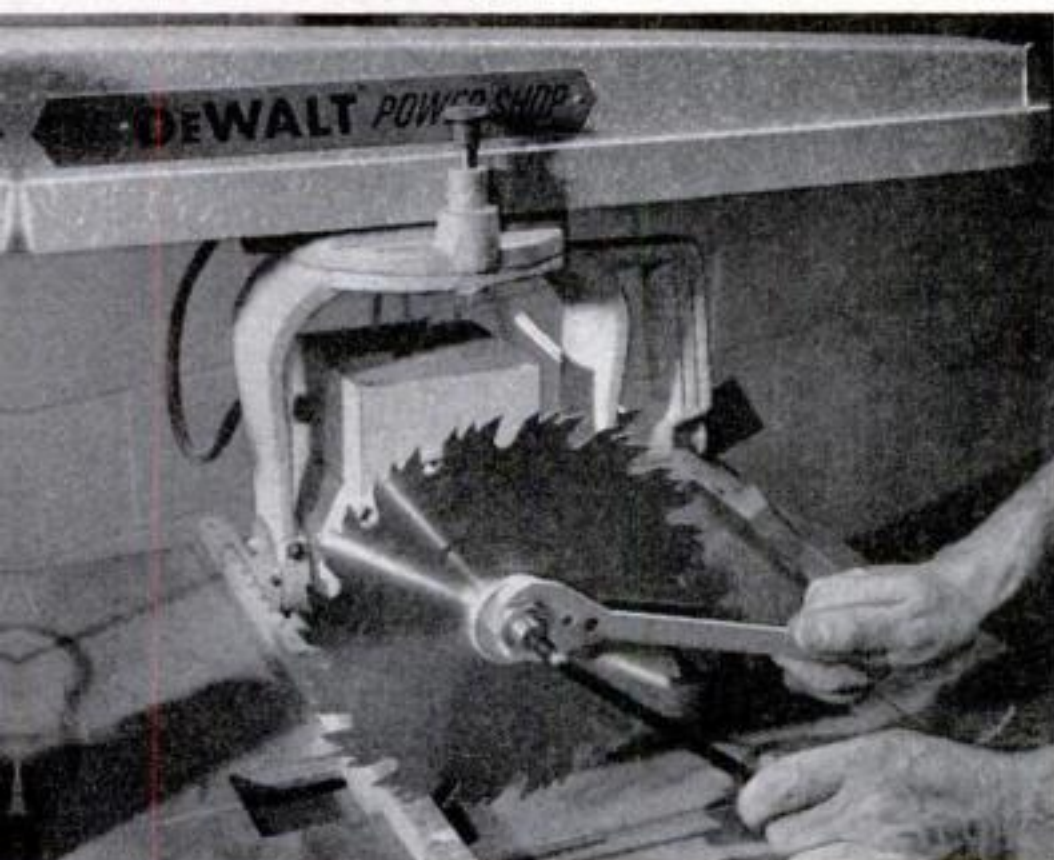


DROP LEAF on cutting table snaps up to support rip cuts up to 25" wide, and to protect fingers from the saw blade as it emerges through the underside of work being cut. With the drop

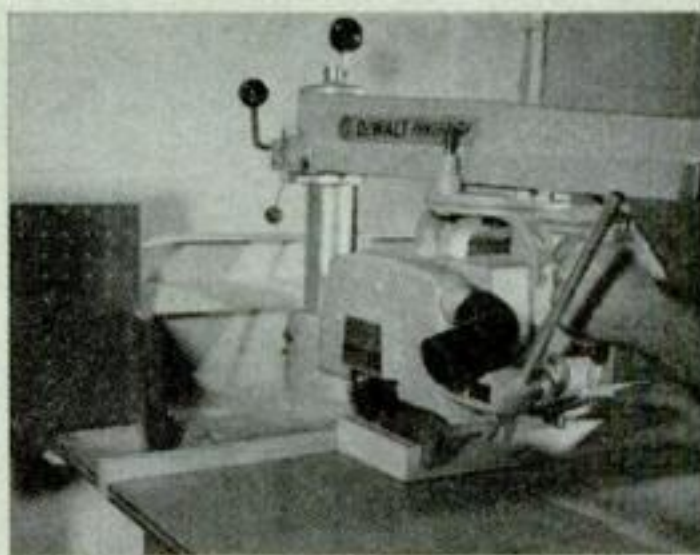


leaf down (right), the new laminated table is the same size as the table on the previous model, permitting cross and diagonal cuts in narrow work from a comfortable position.

and more convenient to use



REPLACING THE BLADE is easier and safer. A hex-hole in the end of the motor shaft lets you hold the shaft with an Allen wrench while you turn the blade nut with an open-end wrench.



YOU can build this dust collector from free plans. It will catch and hold sawdust from cuts made at any angle, including rip cuts. A baffle keeps the dust from bouncing out. To get plans, write to: DeWalt Division, American Machine & Foundry Co., Dept. M, Lancaster, Pa.

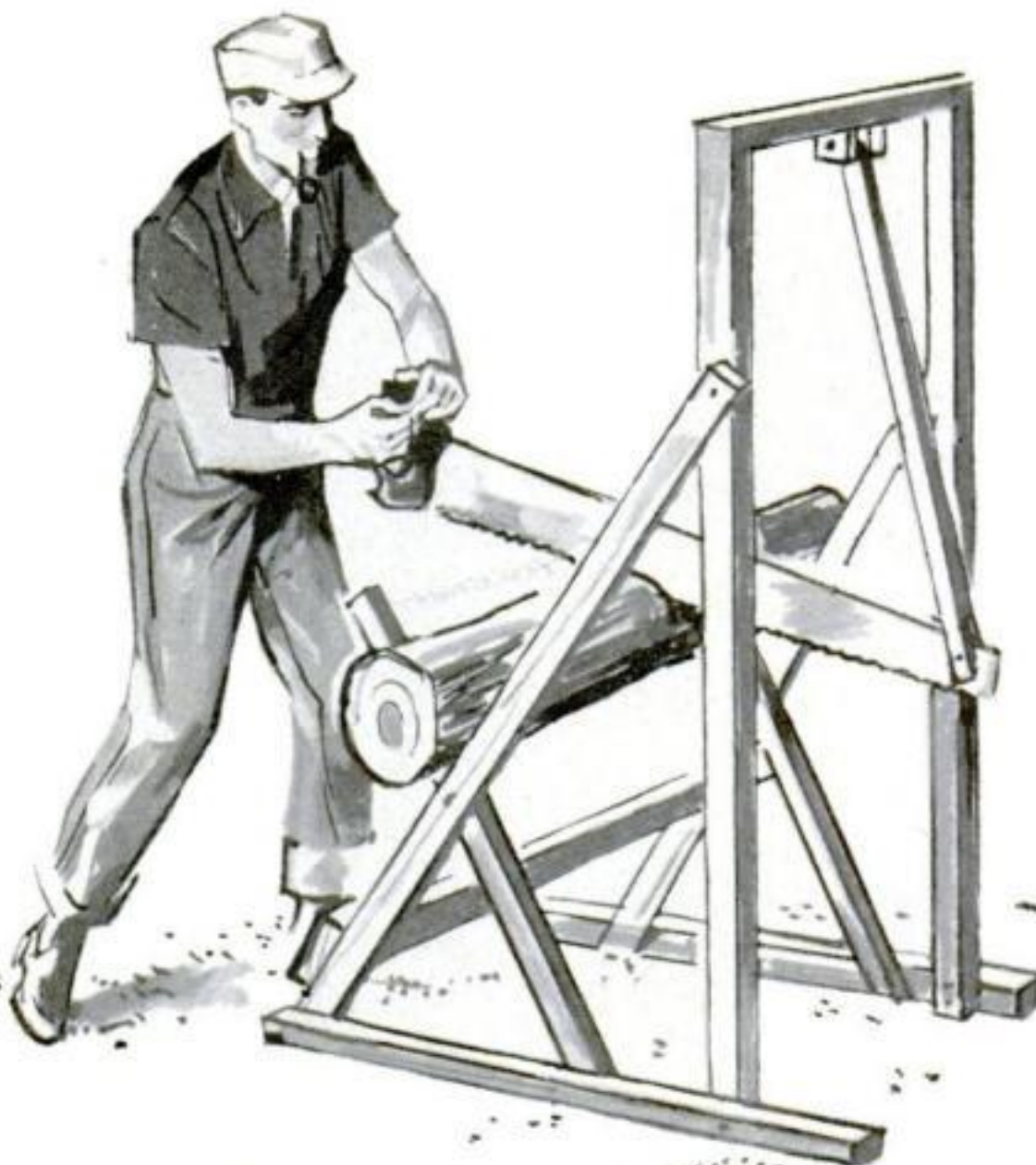
Short Cuts and Tips

FROM PS READERS

One-Man Handling of a Two-Man Saw

IF YOU have a two-man saw and no second man for the other end, a rig like this one contrived by a hired man I know can be a big help in sawing firewood.

He built his sawbuck with an extended back, attached it to an upright frame and pivoted a swinging arm into the top. Then he removed one handle from his saw and bolted that end loosely to the swinging arm.—*Robert Mery, Annadale, N.Y.*



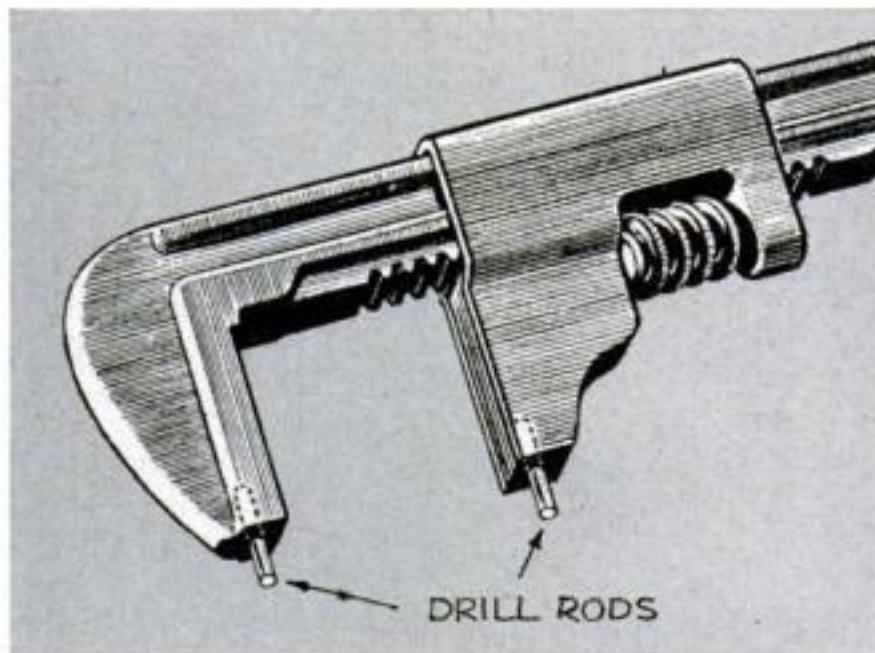
▶▶▶BY PLACING a small square of coarse sandpaper, rough side up, under each leg of a piece of heavy furniture, I now move it without the help of my husband. The smooth surface slides over a floor or rug, while the sanding surface grips the leg.—*Aletha M. Wilson, Mantua, Ohio.*

▶▶▶WHEN sand and water are not available for cleaning burned food from a pot or pan used at camp, you will find an empty tin can a good substitute. Hold it by the bottom and give it a circular motion with the open end against the burns.—*Ken Murray, Colon, Mich.*



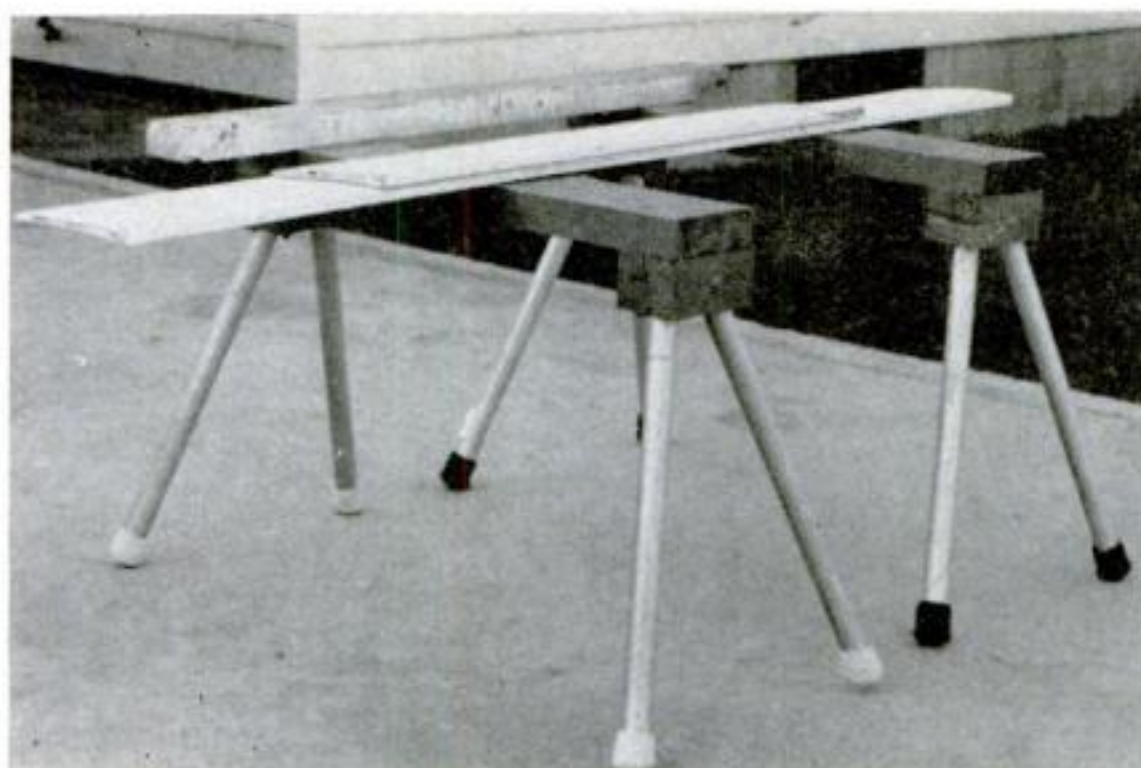
How to Measure a Driveway

I HAD a problem measuring an irregular driveway until I thought of my son's bicycle. I marked the rim of the wheel, and then counted the number of revolutions as I rolled the bike along the drive. Multiplying this by the circumference of the wheel gave me the answer.—*R. J. De Cristoforo, Los Altos Hills, Cal.*



Adjustable Spanner Wrench

YOU can make an efficient variable spanner wrench by fitting the jaws of a monkey wrench with projecting pins. Drill small holes in the ends of the jaws and drive in short lengths of drill rod so they project about $\frac{3}{32}$ ". For a permanent job, weld the rods in the jaws.—*Donald Crepeau, Calumet, Mich.*



Short Cuts and Tips

FROM PS READERS

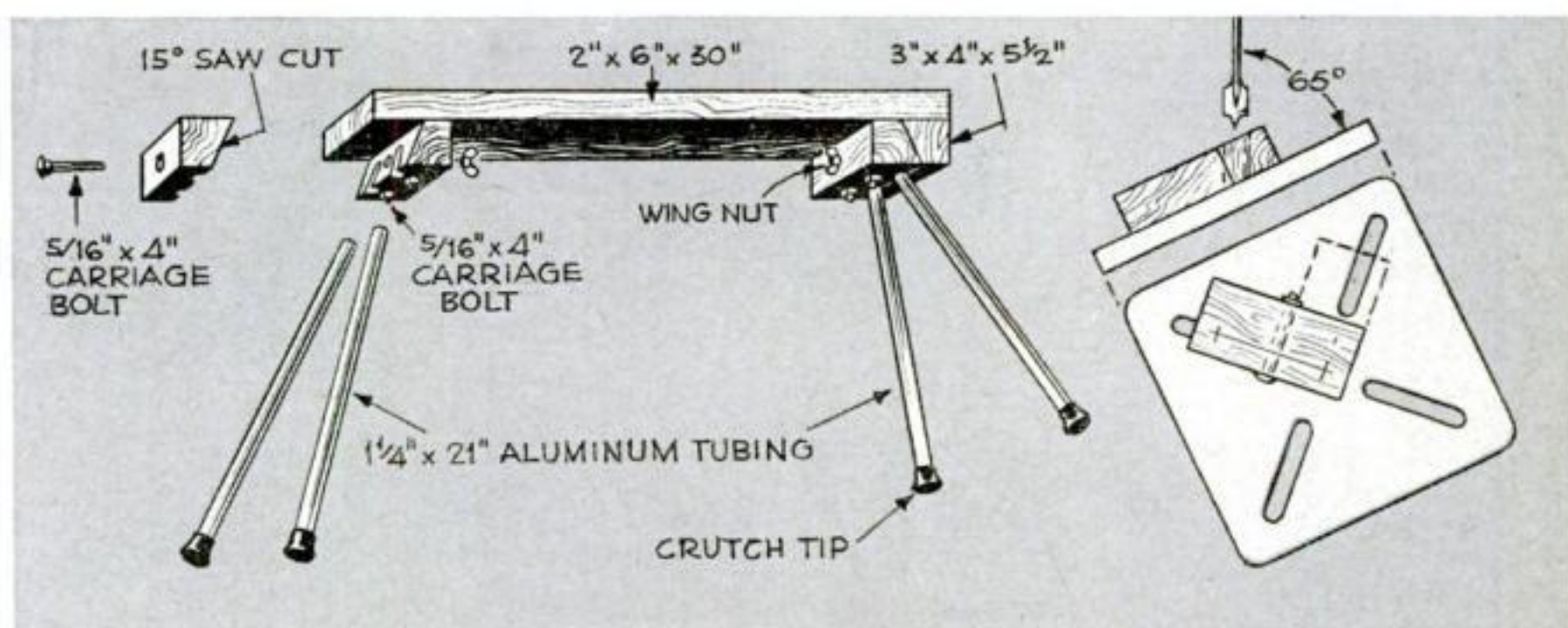


Demountable Sawhorses Can Pack in Trunk of Auto

LIGHT and easily disassembled, the sawhorses I built recently are sturdy enough for heavy carpentry, yet fit conveniently in the trunk of my car. To provide clamps for aluminum-tubing legs, I sawed two 3"-by-4"-by-5½" blocks in half at a 15-degree angle. Then I fastened each pair of halves together with a single bolt.

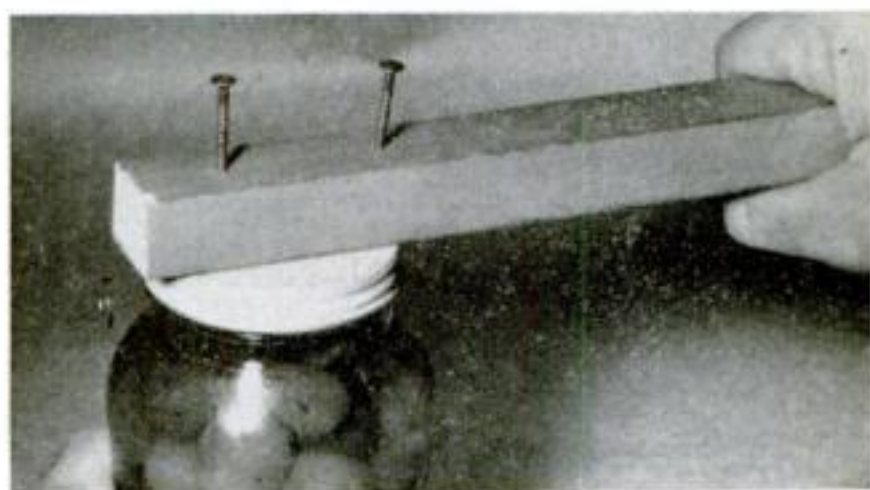
Tilting the table of my drill press 25 degrees from horizontal, I positioned each block at a 45-degree angle, as shown below, and drilled one 1¼"-diameter hole not quite through the stock. Then, re-

versing each block, as shown by the dotted lines, I drilled the other "blind" leg hole. This way the holes followed the 15-degree angle of the dividing saw cuts and, at the same time, angled outward to give the legs a splay in both directions. Rasing a small amount of material from the mating faces of the block halves produced snug gripping action. To assemble or disassemble the horses, I tighten or back off wing nuts on the bolts that hold the stationary and free halves of the blocks together.—*Harry A. Everett, Bloomsburg, Pa.*



Emergency Jar Opener

You can open a stubbornly tight jar top with two nails driven through a 12" length of wood. Let the nails protrude about ½" through the wood, tap the points into the metal top lightly with a hammer, and use the stick as a lever. On very stubborn tops, you may need a helper to hold the jar while you work.—*T. C. Van Alstyne, Don Mills, Ontario.*





10 M.P.H.



15 M.P.H.



20 M.P.H.

1 **AT TAKEOFF**, hull slogs through rough water before the foils start to lift.

2 **BOAT BEGINS TO CLIMB** at about 10 m.p.h. Bow comes up fast, but hull continues to ride tail-heavy.

3 **FOIL-BORNE**, boat clears water, but rides low because of insufficient lift.

Swift hydrofoils, now in do-it-yourself kits, let you get in on this newest boating thrill

Now You Can 'Fly' Your Own Outboard

Flaps up for easy docking and shallow-water runs



FOILS RETRACT on pivoted mounts in this kit to be sold by Dynamic Developments, Inc. The backward slant of the foil struts, seen in the photo at right, automatically swings them up behind front-seat passengers, out of the way. Safe minimum depth with foils down is 3½'.



NUTS-AND-BOLTS ASSEMBLY makes quick work of installing these extruded-aluminum foils once you locate supports on boat.

HINGED SIDE MOUNT has soft shear pin that releases if foil snags, safeguarding boat. Cable on foil lets you retrieve it easily.





40 M.P.H.

4 AT TOP SPEED, foils ride up on tips only a few inches below surface. Two forward foils support about two-thirds of boat weight, the

single tail foil one-third. Standard extension shaft, available for most motors, keeps prop down in water. Foils here are Dynamics'.

**By Sheldon M. Gallagher
with photos by W. W. Morris**

I HAVE just "flown" a speedboat clear out of water. I did it on wings that work exactly like an airplane's except that they ride underwater.

These underwater wings—hydrofoils—have been around experimentally for many years. Every major seapower in the world has its eye on some form of high-speed, foil-borne attack boat, flying sub or swift passenger ship. [PS, March].

But today the big news is:

- This summer, you can buy hydrofoils in kits to attach to your own outboard.

- You can skim over wave tops at breath-taking speeds, bank into turns and make takeoffs and landings like an airplane.

- You don't need special boats or expensive engines. Hull shape makes little difference because it doesn't touch the water. You can mount foils on practically anything from rowboats to runabouts.

More boat for your buck. For plodding, middle-aged hulls, hydrofoils are as wickedly delightful as a sly flirtation. The foils—slim slivers of aluminum—reduce drag so much that you can go up to twice as fast with the same engine.

On one set of foils, I hit 40 m.p.h.—hair-raisingly fast on water—with a

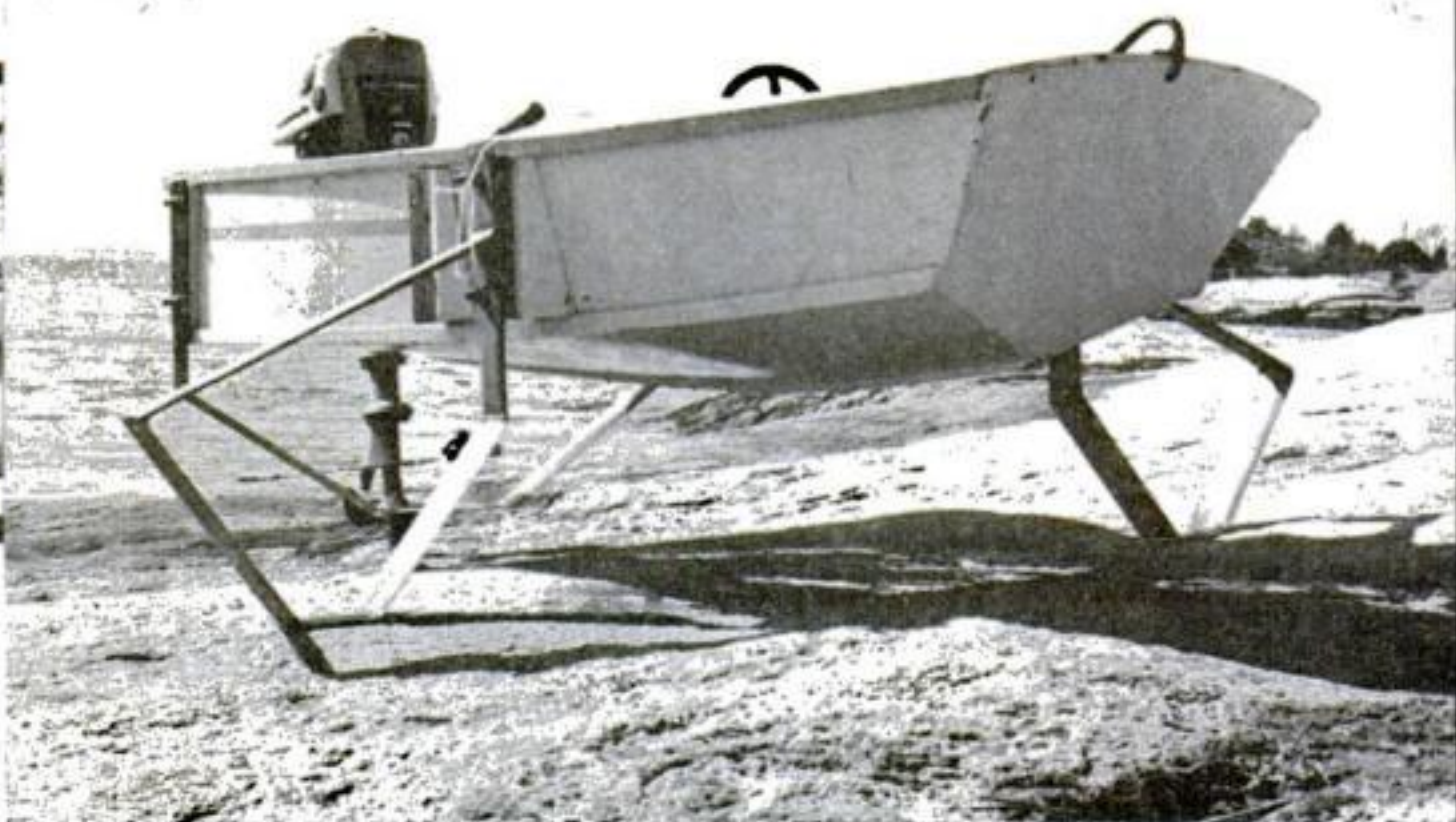
TIGHT TURNS are made with almost no skidding because foils act like keel or lee boards, preventing sideslip. Note nearly dead-flat attitude

of hull, showing its stability. Banked turns can also be induced by trick of cutting throttle, then speeding up to drop inner foil.





TINY 8' PRAM, fitted with Roberts foils, gives you thrilling rides at modest cost. Only eight bolts hold the foils to the sides of the boat.



35-hp. engine. On other foils, I made almost 30 m.p.h. with—believe it or not—a tiny 7½-hp. motor.

This means simply—whether motor makers like it or not—that you'll spend less on engine power to get more speed than ever before.

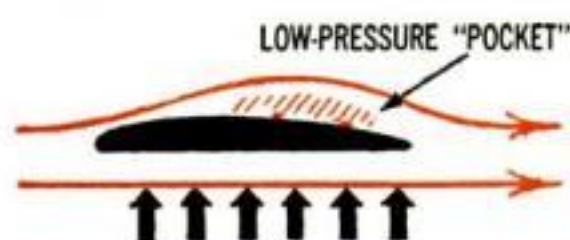
What they are. Two hydrofoil kits will be available this summer. One type,

designed for 14' to 16' runabouts, will be sold by Dynamic Developments, Inc., in Babylon, N. Y., an affiliate of the Grumman Aircraft Engineering Corp.

A smaller set of foils, for boats 8' to 14', will be offered by Roberts Industries in Branford, Conn.

Both the Dynamics and Roberts kits consist of two main forward foils, one for

Why foils fly—and what happens when they don't



FOILS LIFT when forward speed reaches point where water rushing over the top produces low-pressure "pocket" above them. Water at normal pressure below foils then pushes them upward.



FOILS STALL when speed decreases to point where water closes in on the low-pressure pocket, causing it to collapse. Foils lose their lift and boat glides to a landing.



FOILS "CAVITATE" when speed increases to point where pressure above them drops so low that the water actually boils. Turbulence then causes foils to lose their lifting power.

Why foils keep a boat from tipping

SUREFOOTED stability of a tripod is the result of this three-foil arrangement used by both Roberts and Dynamics. Because upward lift is exactly equal on the two forward foils, they balance

each other (below, left). If the boat heels, the foil on the down side digs in deeper (right), its lift increases because more foil area is underwater and it forces the boat back up on an even keel.





each side of the boat, plus a single tail foil. The foils are shaped like an actual airplane wing—flat on the bottom and rounded on top. Water flowing past the foils produces a low-pressure “pocket” above them. Water below the foils keeps trying to push them up into the pocket, and this upward thrust is what keeps your boat up on “stilts.”

Unlike some foil designs that require intricate controls to keep them riding at the right water level, both the Dynamics and Roberts foils are of a simple self-stabilizing type called “surface-piercing.” The foils enter the water at an angle, part way in, part way out. At low speeds, more foil area is needed to support the boat, so the foils sink deeper. As speed increases, they ride up until only the tips remain submerged.

This way, the foils automatically stabilize themselves at the level where their lift exactly equals the weight of the boat. Your throttle is the only control you need—push it forward to climb, pull it back to land.

Controllable tabs—like tiny ailerons—allow the Dynamics foils to be trimmed under varying loads, but once set do not require further adjustment. The Roberts foils are trimmed by loosening bolts to adjust their angle of attack.

Baptism by boat. On a gray, wind-whipped day off Long Island, I got my first crack at the Dynamics foils.

As we throttled up for takeoff, the hull pounded under the impact of two-foot-high surf—a shuddering reminder of what it would be like in an ordinary planing hull. Suddenly the bow lifted, the water fell away and the pounding faded into a seemingly eerie silence despite the roar of the engine.

I glanced at the speedometer. Within five seconds, we had accelerated to 20 m.p.h. Once the hull was clear of the water, acceleration increased rapidly, and



FLYING LOW: 10-horse kicker on this Roberts pram zooms it along at 30 m.p.h. On many boats, foils will come close to doubling speed.

in an instant we had zoomed to an astonishing speed of 40 m.p.h.

Fully borne, the foils were slicing thin, wakeless trails in the froth two feet below us. We were riding on the points of two inverted triangles not more than six inches below the surface.

On the climb-out, the problem of unsticking the hull from water suction—well known to seaplane pilots—is cleverly solved by angling the forward foils so they begin to lift first. As the bow comes up, it tilts the tail foil at the proper angle for lift, and the stern rises. This “shoe-horning” helps pry the boat up, overcoming suction.

Solid as a rock. I held my breath as we quartered into the wake from a large launch. There wasn’t a quiver because the waves never touched us.

I looked astern to find that our own boat was producing practically no wake at all—something that water skiers will take great comfort from.

Turns take practice. Your first turn in a foil-equipped boat is likely to be unforgettable. The foils are so naturally stable that the boat turns almost dead-flat without skidding. Until you learn to expect this, the centrifugal side thrust

[Continued on page 210]

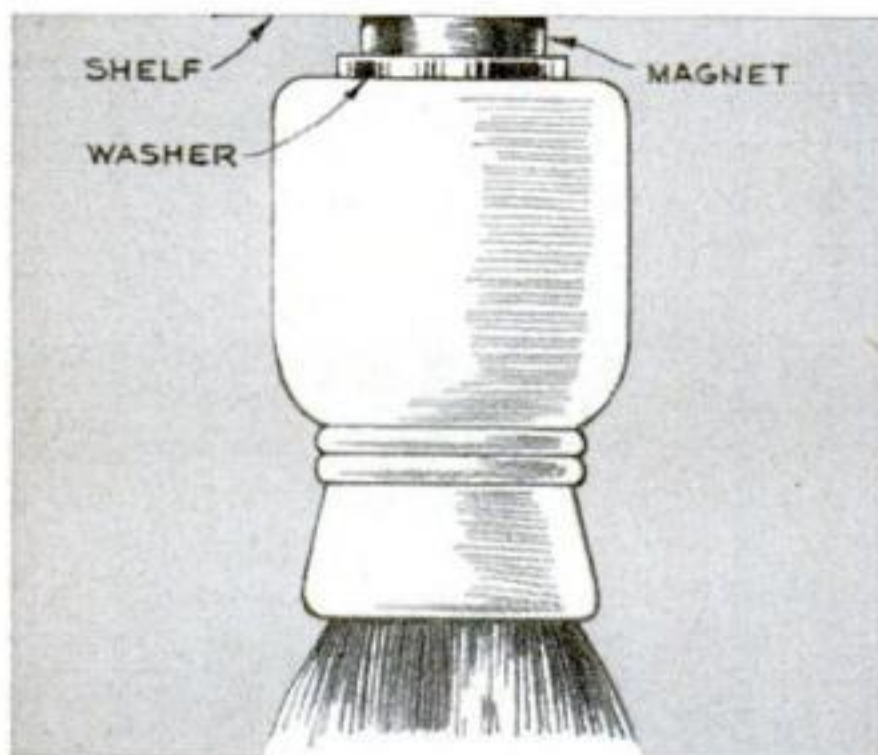
Short Cuts and Tips

FROM PS READERS

Elevated Winch for Heavy Lifting

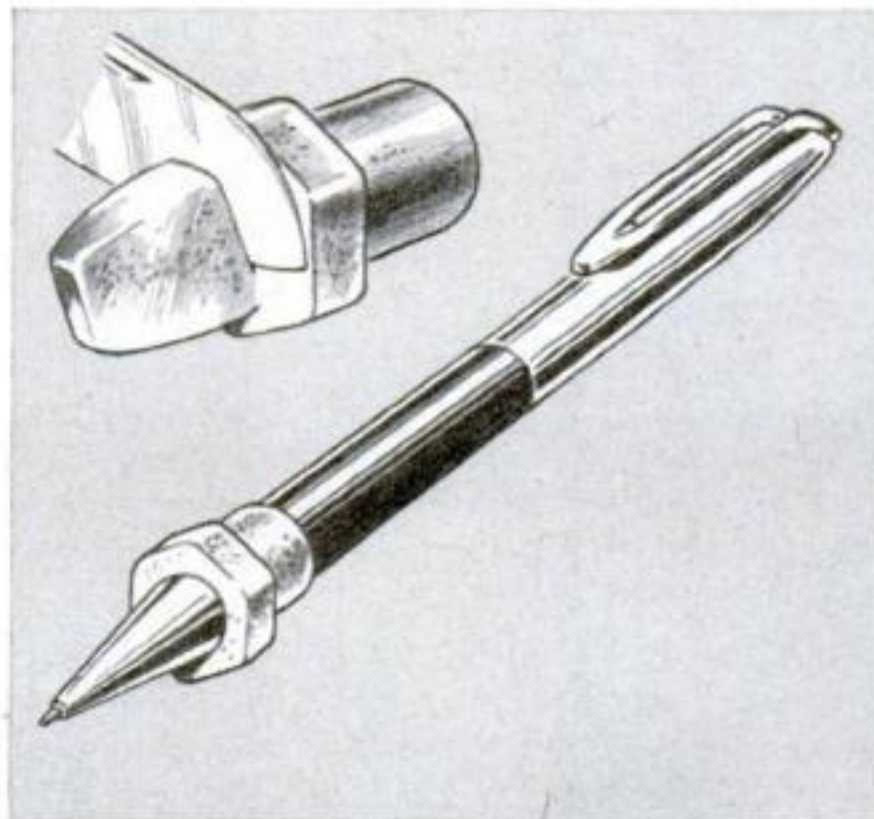
BACK muscles are spared by this winch, built on the floor above a farm-machine shed. It is positioned just over the driveway so it can be used to lift machinery and other heavy objects out of trucks.—*A. M. Wettach, Mt. Pleasant, Iowa.*

▶▶▶ MOTOR vibrations and uneven ground made gas spurt from the air hole in my mower's gas cap. So I covered the cap with a piece of cloth held in place by a rubber band. Air still gets in, but no gas sloshes out.—*Anthony Lepkowski, Meriden, Conn.*



Shaving-Brush Rack

AN EASY way to store a shaving brush so the bristles will dry quickly is to hang it under a shelf. Cement a small washer to the end of the handle and attach it to a button magnet mounted on the underside of the shelf.—*Rudolf F. Graf, NYC.*

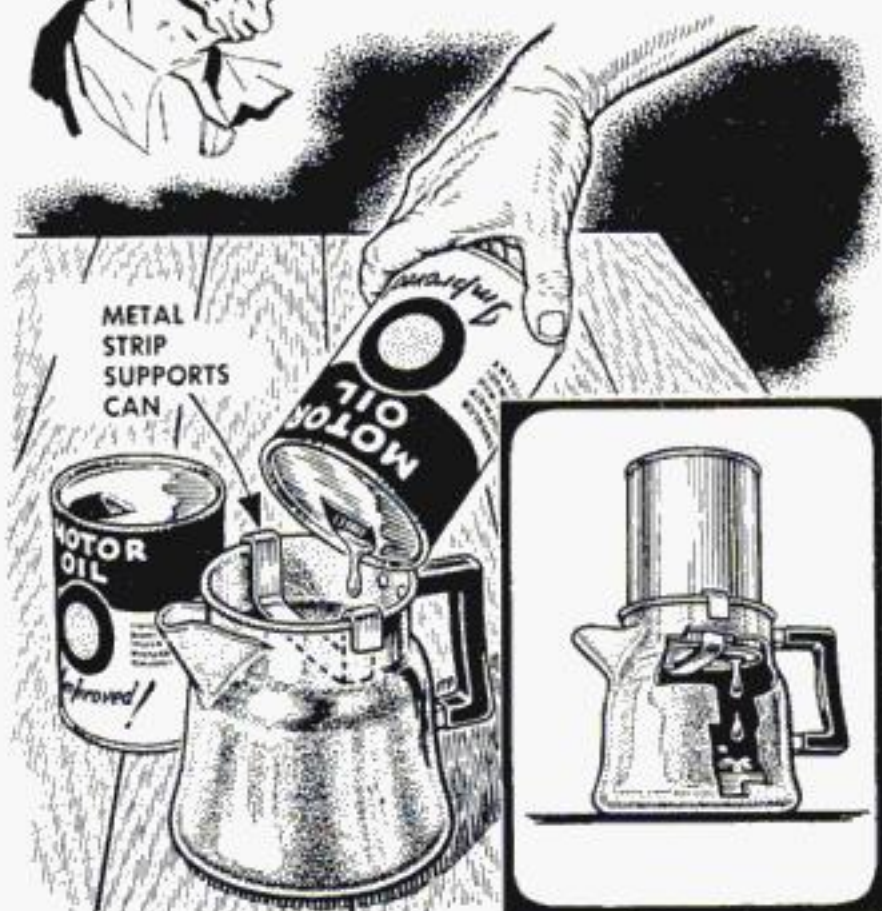


Non-Rolling Ball-Point Pen

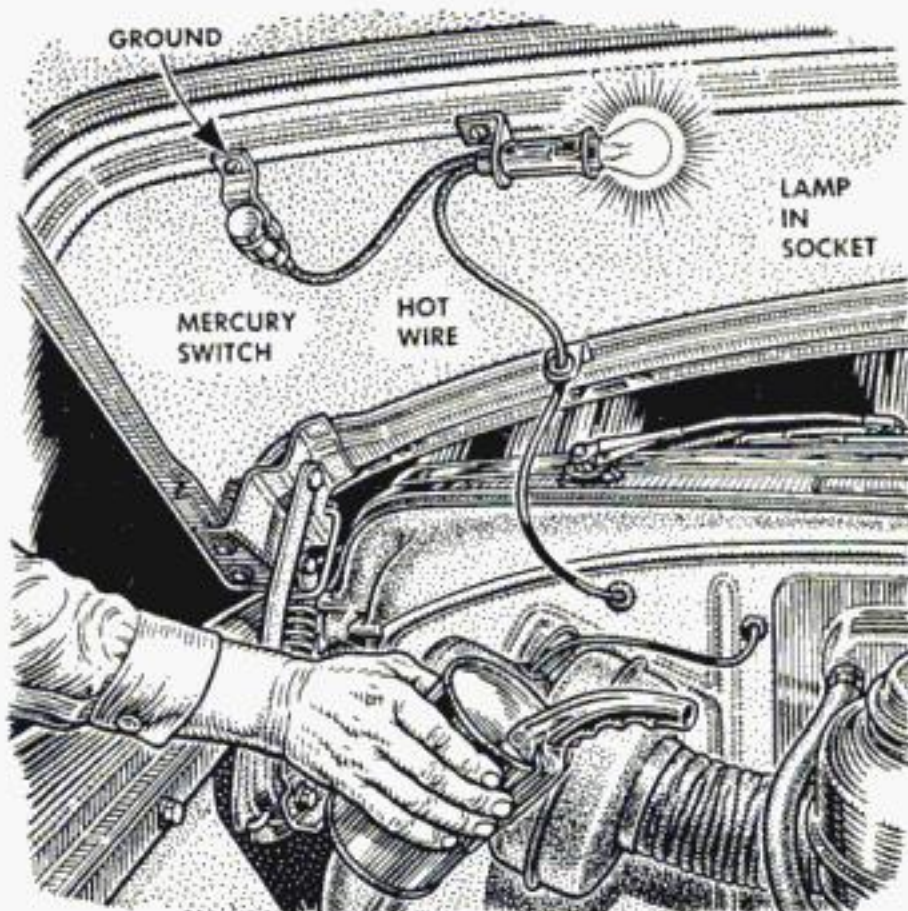
I CUT the end off a rubber eraser of the kind made to fit over the end of a pencil and slipped it on a ball-point pen. Its hexagon edge keeps the pen from rolling off my desk; the rubber makes a non-slip grip.—*John S. Wozny, Cleveland.*



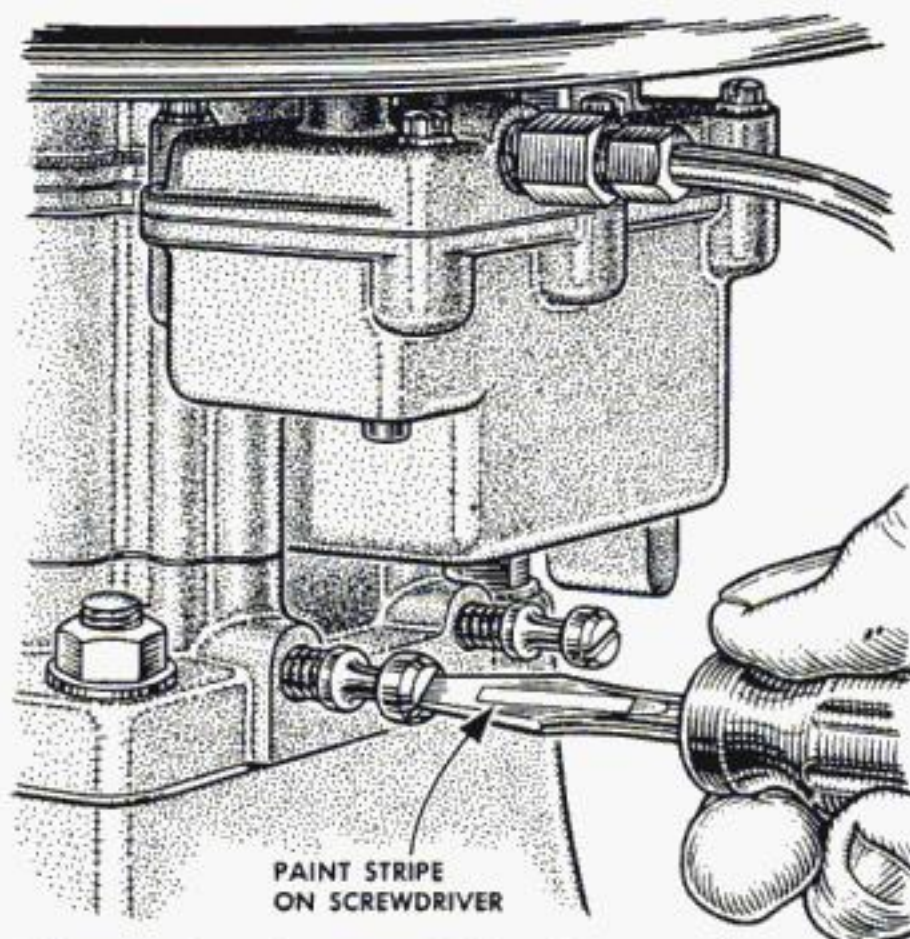
Hints from the Model Garage



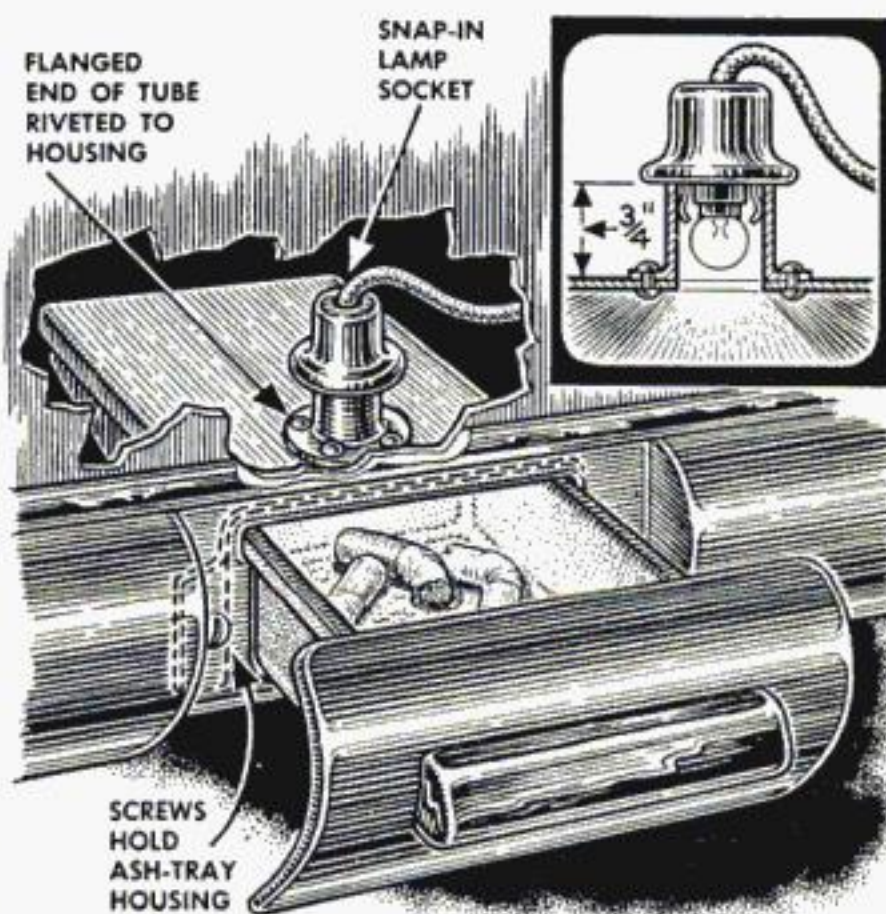
You can get a free quart of oil simply by catching the drippings from 20 or 25 oil cans. Up-end the cans and let them drain slowly into an old, clean coffee pot. Do the draining in a warm place to thin the oil and help it flow easily.



An automatic light that turns itself on when the hood is raised is a convenience when servicing your engine at night. A tail-light bulb, socket with bracket and mercury switch can be purchased at any auto-supply store. Connect as shown.

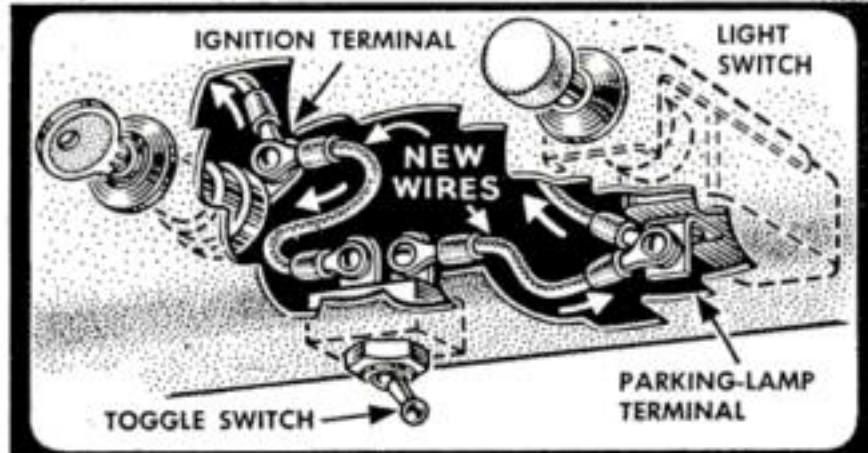


It's easier to count the turns when adjusting the idle screws on a carburetor if you paint a mark on one side of the screwdriver blade. Each time the mark comes into view, you know you've made one complete turn; no mark, a half turn.

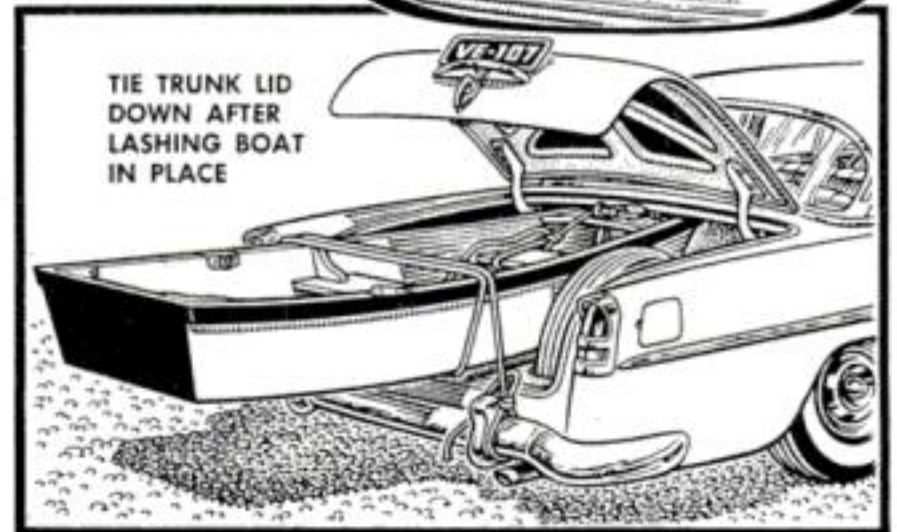
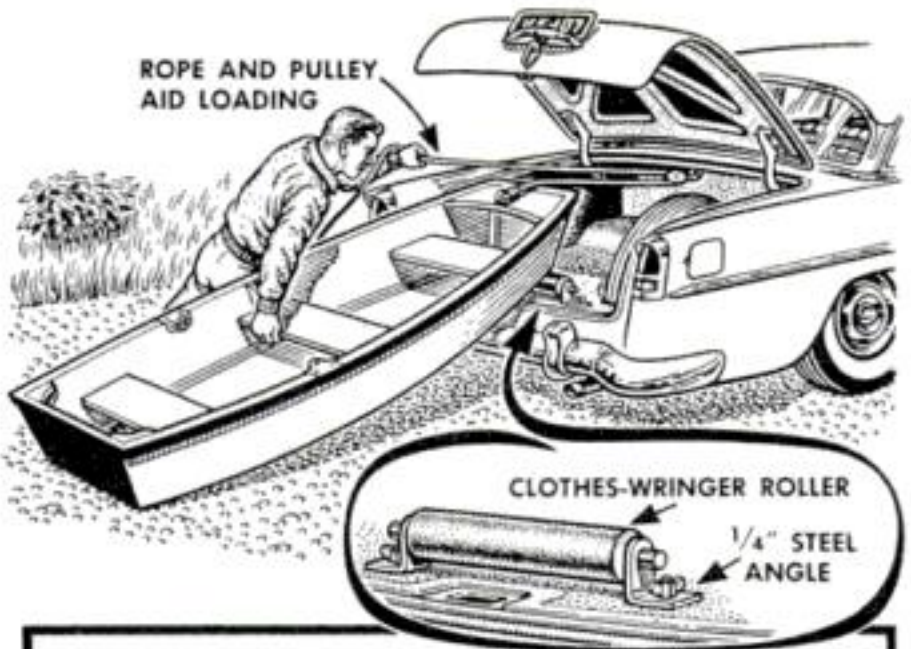


Find your ash tray in the dark by adding a light to its housing. Unscrew the housing, drill a hole in its top, and rivet or solder a short length of $\frac{1}{2}$ " tubing over the hole. Install a snap-in socket and run the wire to the dash-light switch.

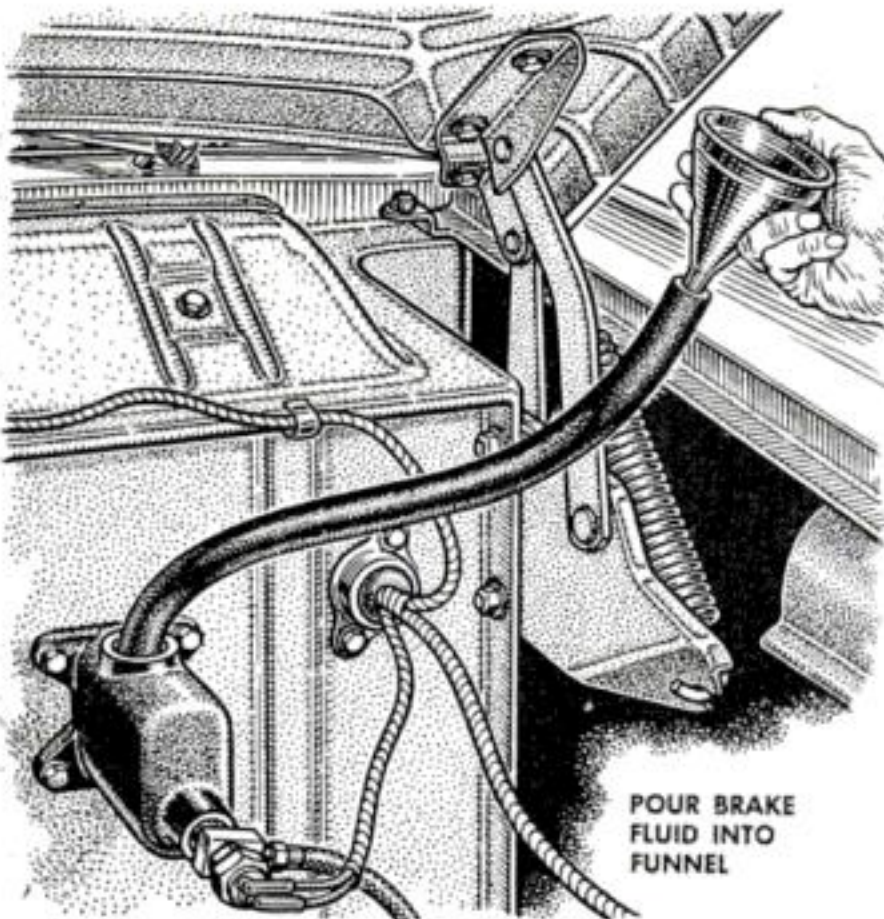
More Hints from the Model Garage



Wiring parking lights separately through the ignition switch automatically turns them off when you cut the engine after the early-morning trip to the station. A toggle switch permits use of parking lights with headlights for special effect.



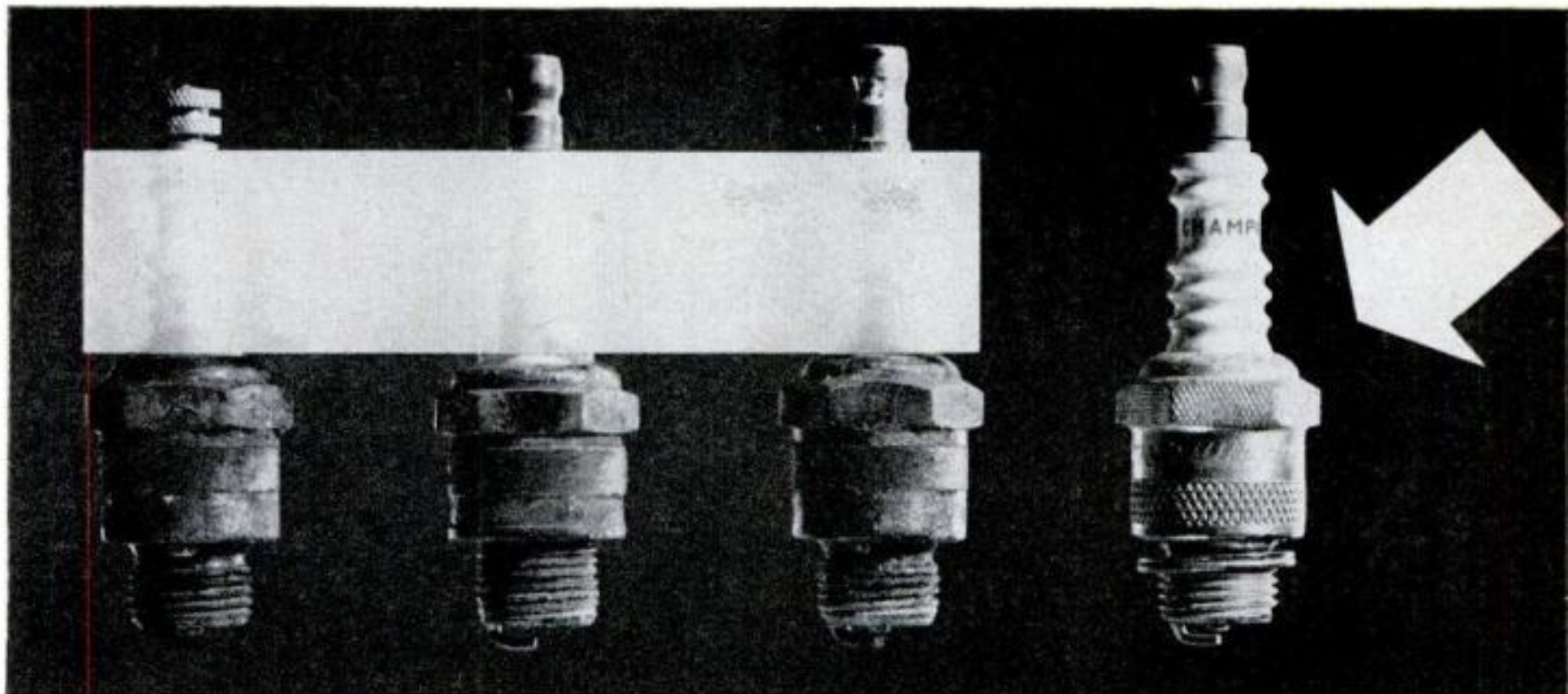
You can load a pram single-handed in the trunk of your car with this setup of pulley and wringer roller. Rest the bow on the roller, and ease the weight off the stern as you pull the pram into the trunk with the rope and pulley.



A hard-to-reach master cylinder can be filled with brake fluid through a short length of hose and a funnel. Insert the hose in the cylinder opening and slowly pour fluid into the funnel. Check the level occasionally to avoid overfilling.



No need to wait 60 days or more before polishing cars painted with acrylic finishes. They can be waxed four days after painting. Don't use a polish containing benzene, toluene or xylene as these chemicals may dull the acrylic finish.



All these plugs got the same rust-making treatment. Plated Champion (right) is still shiny . . . one reason every major outboard maker now installs plated marine Champion spark plugs.

Special plating and waterproof pack make the difference...

See how new Champion marine spark plugs — carried as spares — resist rust longer than any other plug!

Photo above shows different plugs after identical treatment. That shiny one at far right is a plated Champion marine plug. Here's what these plugs went through . . .



Plugs are first soaked under water and air-dried, several times. In your boat, spare plugs often lie in damp places.



Corrosive salt is added, plugs get more soaking and drying. This is tougher than the worst conditions in salt-water areas.



Now for a rust-building dose of alternate spraying and drying. Notice how plated Champions resist rust under any conditions.

The spark plugs you carry as spares will never have to undergo a torture test like this. But they *will* be subjected to spray and damp air . . . and the danger of rusting. In the protective waterproof pack, Champion plated marine spark plugs can't possibly rust. After the pack is opened, Champion's rust-resistant plating virtually eliminates any chance of rust, as these tests show. And there's no danger of losing the gasket when you install these new Champions. It's attached . . . can not fall off.

Be sure *your* engine will always have the full-firing spark it needs for smooth, dependable power. For fun and safety, always carry a spare set of the world's finest marine spark plugs—plated *Champions* in the *waterproof* pack.



Champion Spark Plug Company, Toledo 1, Ohio

YOU'RE A SAFER SKIPPER WITH A SPARE SET OF CHAMPION SPARK PLUGS

JUNE 1959 185

Gus

"Want to stretch your legs?" Gus asked. "It'll take me half to three-quarters of an hour."

"That's okay," said the thin-faced man. "I'll stay in the car."



RAY QUIGG

Turns Private Eye

By Martin Bunn

"I TELL you the guy's smart," argued State Trooper Jerry Corcoran.

Gus Wilson smiled. "Maybe he isn't so smart. Could be just that the police are getting lazy, so all-fired dependent on scientific aids that you've forgotten old-fashioned detective work."

"Okay, I'll get out my deerstalker cap and magnifying glass," Jerry said, recognizing the Model Garage owner's good-natured ribbing.

"No, I mean it," Gus countered, running a cloth over the trooper's windshield. "If the two-way radio, FBI fingerprint file, or some other gadget doesn't dump the criminal right in your front yard, you're stumped, and blame it on the smartness of the 'one that got away.' Like when you go fishing."

Jerry gunned the engine of his patrol car. "Any time I arrest a thug in my front yard, I'll buy you that new glass fly rod down at Harley's Sporting Goods." He pulled away and headed north up the highway toward the state police barracks.

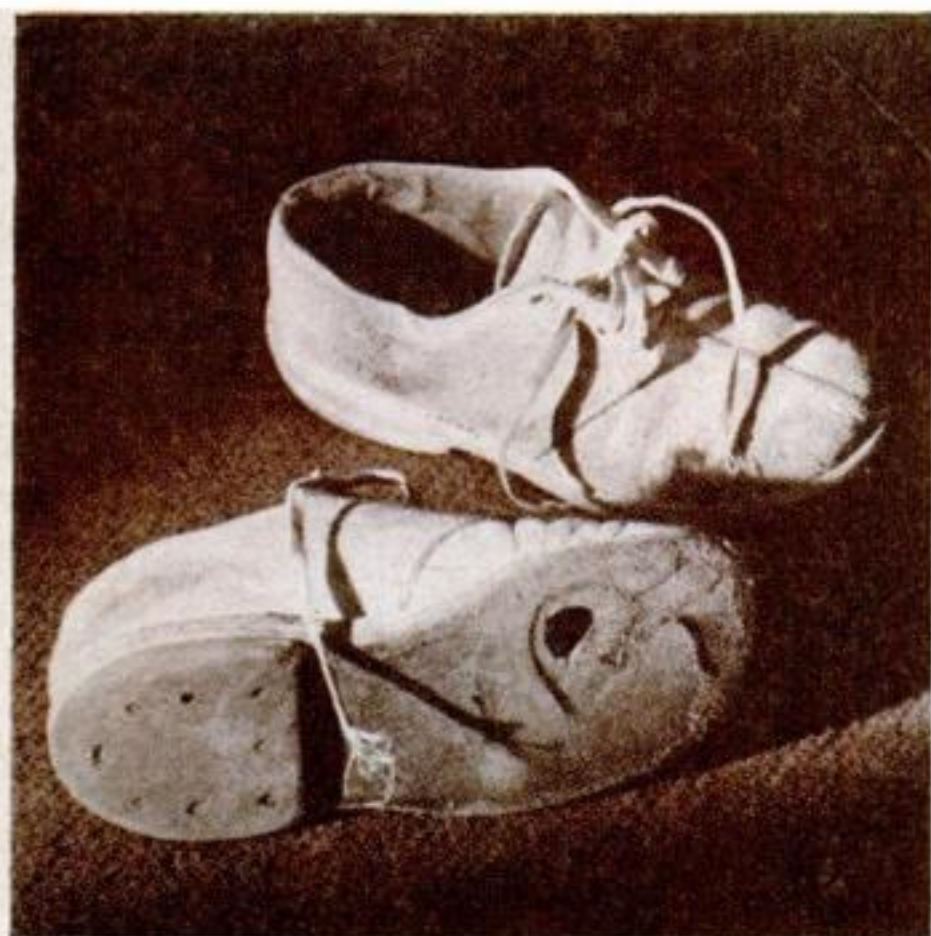
"What's it all about, Gus?" asked Stan Hicks, his young assistant, sticking his head out from under the grease rack, on which stood a pickup truck.

"The Tasty Grill was held up a little while ago and the bandit made a clean getaway. The state police are setting up roadblocks. Only trouble is the witnesses can't agree on the model, make, year or color of the car."

OUTSIDE, a car braked and a door slammed. "Think we got a customer, Gus," said Stan, putting down his grease gun. A moment later a thin-faced man walked into the garage.

"How about washing my car, Mac?" he asked, in a gravelly voice. "And a tuneup after."

"Right away, mister," said Gus. "You



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They stop oil-pumping, seal compression and provide the special lubrication worn engines need.

Don't gamble with the power and economy that are built into your engine. Restore it, keep it, enjoy it. Get new rings. And be sure they're Hastings—the only rings engineered exclusively for replacement service in your car. Truly the best money you can spend on your car.

HASTINGS
PISTON RINGS

TOUGH on oil-pumping
GENTLE on cylinder walls



HASTINGS MANUFACTURING COMPANY
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Piston Rings, Casite, Oil Filters, Spark Plugs

take care of the laundry, Stan, while I finish up this lube job."

Gus had finished the pickup and was putting his tools away when Stan came back from the wash rack. "Was that car dirty!" he said. "But you should see it now with the mud off. Some paint job!"

"Pretty flashy, eh?"

"I wanna tell you. By the way, do we have a 1949 Plymouth hood insignia? Fellow says some kids stole his."

"Might have," Gus said. "Look in the drawer of that old chest in the back room."

The man with the '49 Plymouth drove in, guided by hand motions. Gus whistled softly as his eyes ran over the car.

"Pretty snappy," he said.

"Yeah." The driver made no attempt to get out.

"Want to stretch your legs?" Gus asked. "It'll take me half to three-quarters of an hour."

"That's okay. I'll stay in the car."

AS GUS went to work he was struck by the excellent condition of the engine. It was clean. He checked the spark plugs. Perfect. His eyes took in such features as a brand-new battery and a new fan belt. Carburetor and fuel line were both clean. Rolling over the engine analyzer he paused at the open car window. "Car's in pretty good shape," he remarked.

"Yeah," was the laconic reply. The man had his nose buried in a newspaper.

"Looks like you had a tuneup not long ago," Gus persisted.

"I like my car to run good."

Stan appeared. "I found an insignia, Gus, only one we had."

"Okay, put it on. There's something I want to check at the rear end."

Stan had the hood up again when his boss came back and continued with the tuneup. He took off the distributor head and examined the points. They were set perfectly and timed to the split second.

Gus pulled his ear thoughtfully, then walked up to the man. "You need a new set of points, maybe?"

"If you say so, Mac. But get on with the job and don't ask so many questions."

That's odd, Gus mused. He must know he doesn't need new points, yet he's going to let me put them in. He hollered to Stan, "Get me a set of points for a '49 Plymouth."

When Gus had replaced the points he examined the old ones. Looking at the composition bushing, the part that pivots on the upright pin of the distributor plate, he noticed that it had been reamed, probably with extra-fine sandpaper.

Stan was looking over his shoulder.

"But, Gus, you didn't . . ." The Model Garage owner shut him up with a kick on the ankle, lowered the hood, and stepped to the window of the car.

"I guess that's it," he said. "I'll make out the bill."

"Never mind, Mac." He handed Gus a twenty, backed off the rack, drove out of the garage, and with a screech of rubber headed north up the highway.

GUS dashed to the office telephone, Stan following him. "Give me the state police barracks." Drumming nervously on the desk he waited for the connection, then asked for Jerry Corcoran.

"Jerry, I want that new fishing rod." There was a sputtering at the other end.

"Cut the comedy," Jerry exploded. "That guy who held up the Tasty Grill is still loose and we're busy."

"Take it easy, Constable," Gus continued. "Can you see the highway from where you're sitting?"

"Yes, but . . ."

"Is a '49 Plymouth with a fresh paint job sputtering and jerking up the road?"

"Why—er—yes! How did you know?"

"Skip it. Now, if my guess is right, he'll be coming to a dead stop . . ."

"He just did!" exclaimed Corcoran.

". . . and he'll get out and raise the hood . . ."

"He is. He's doing it! Is this a gag, Gus?"

"No gag, Jerry. I'll give you the answer if you'll admit one thing."

"What's that?"

"Is he in your front yard?"

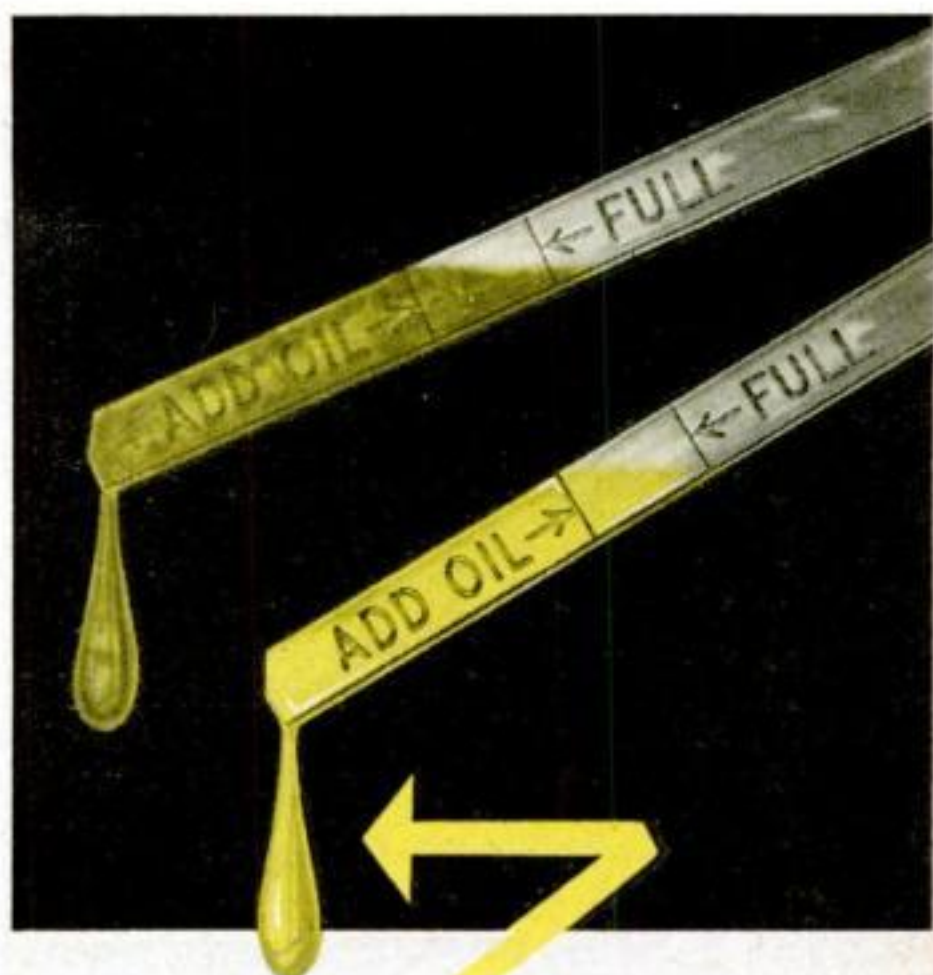
"Sure, sure, but . . ."

"Okay. Now don't ask any questions. I'm serious. Go out there and arrest him. Unless I miss my guess he's the guy who held up the Tasty Grill."

Gus sat down in a chair and mopped his forehead. "Whew!" he exclaimed, turning to Stan. "Remind me never to play detective again. It's too hard on the blood pressure."

"What tipped you off, Gus?"

"Elementary, my dear Stanley. I fig-



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ured things weren't adding up right. Why would a fellow with a new shiny finish let it get all covered with mud?"

"Driving in this rainy weather we've had," Stan suggested. "Trucks and passing cars can throw a lot of mud."

"Then why wouldn't he have mud and caked dust on the underside of the car? There wasn't any. It was clean."

"Oh."

"To hide, that's why. He was smart, as Jerry said. Witnesses wouldn't be able to describe the color of a car covered with mud—on purpose. A car wash was as good as having it repainted. And then

causes the bushing to bind and the points can't move. And I helped it by easing off spring tension."

"I get it," Stan said. "But suppose the car hadn't conked out right in front of the barracks or he'd turned off on a side road?"

Gus filled his pipe, lighted it, and took a long draw. Expelling a lungful of smoke, he said, "I thought of that, and I admit I hedged my bet a little."

"You pulled another trick?"

Gus nodded. "While you were putting the shield on in front I stuffed his exhaust pipe with waste. After a couple of

miles the exhaust gases would have built up back pressure and overheated the engine."

Stan grinned. "He didn't have a chance."

"Not much," Gus agreed. "Even if the points gimmick hadn't worked, he wouldn't have gotten far. And with the police having a description of both the man and the car, they'd have nabbed him."

A police siren broke the evening stillness as Gus was

there was the shield, another bit of identification he removed."

"But he might have gotten clean away," Stan protested.

GUS chuckled. "Not with the points I installed. The ones I took out had the composition bushing reamed. It was too snug. The ones I put in were snug, too, but I didn't ream."

"I noticed that."

"That's why I shut you up, Stan. Remember the trouble we had with Judge Trumbull's '49 Plymouth? We put in new points, tuned the motor. It ran fine for a few minutes, then stalled. That's when I learned about reaming. I figured our friend would head north, back to the scene of the crime where he wasn't expected—and get just about to the police barracks. After just a little use, friction

washing up, ready to call it a day. Jerry Corcoran pulled up in front of the Model Garage and climbed out of the patrol car carrying a glass fly rod.

"You sure earned this," he said, handing Gus the fishing gear.

"Got your man, eh?"

"Thanks to you. He had the money on him and we got positive identification from the Tasty Grill owner and three customers."

Gus began to assemble the rod.

"I don't know how you did it," the trooper went on, "but you and I are due for a good long talk—and I want straight answers."

"The only answer," said Gus balancing the fly rod, "is good, old-fashioned detective work. So long, Constable. I've other fish to catch."

END

Next Month: Gus meets a medicine man.

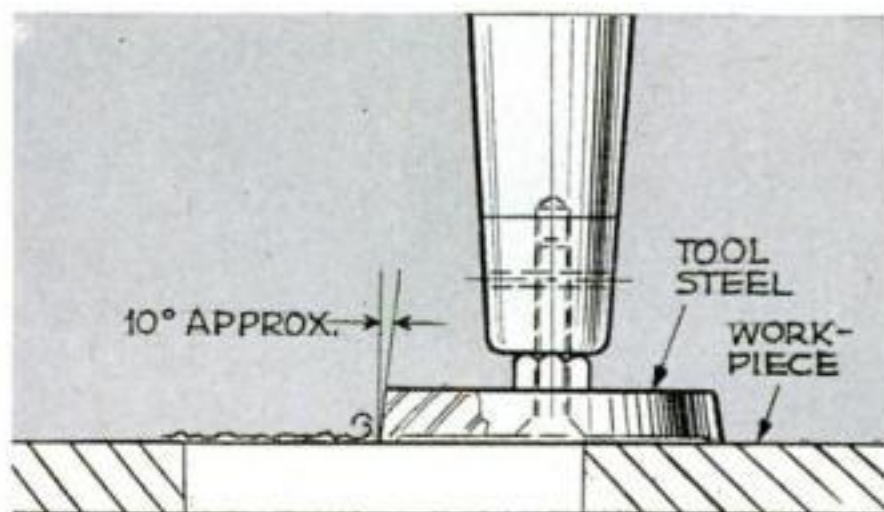


"Hey—watch where you're goin' when you back up!"



Cleaning Clogged Lawn Mower

CLEARING a clogged grass chute or underside of a power mower is a messy job. But by using a discarded windshield scraper, you can keep grass stains off your hands. To have it handy for frequent cleaning while mowing, hang it on a wire hook bent over the handle of the mower.—*William B. Eagan, Owensboro, Ky.*



Handy Tool for Removing Burrs

THIS deburring tool will do a fast job of cleaning up drilled holes in metal. Turn a disk from scrap tool steel with a bevel of about 10 degrees on the edge, and drill and countersink the center to take a flat-head screw. Recess the working surface slightly. Insert the screw into a file handle and cross-drill for a pin to lock the handle in place. The tool will remove burrs without scratching the surface.

You can shear heavy burrs easily if you use a twisting motion as the tool is pushed along.—*F. Murray, Chicago.*

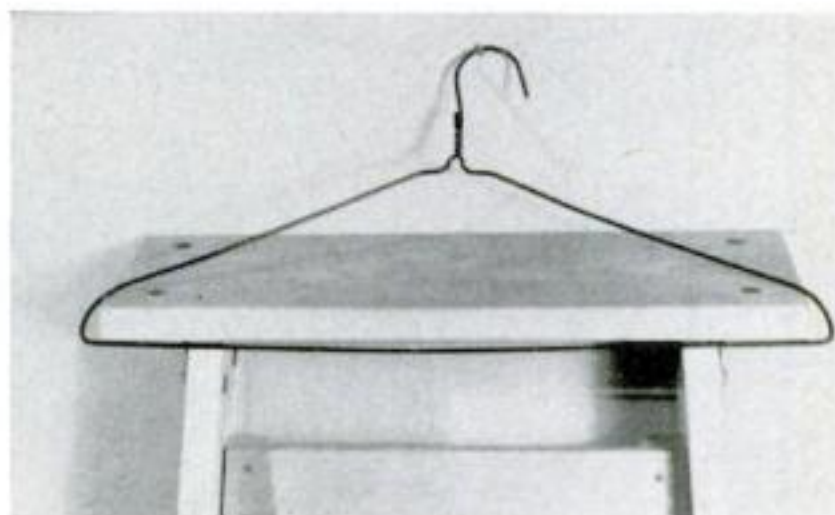
Short Cuts and Tips

FROM PS READERS



Flattening Warped Records

You can take the warp out of a thin 45-r.p.m. record that has been left out in the sun too long by heating it very cautiously over a stove burner. Then cool the disk between two flat surfaces with a weight on top. Be sure not to heat too much, or you may melt the grooves.—*Robert W. Bonney Jr., San Diego, Cal.*



Step-Ladder Hanger

USE an ordinary wire coat hanger to hold a step ladder flush against your basement or garage wall. Just drive a screw-eye in the wall 4" or 5" above the ladder. Insert the hanger hook in it and loop the hanger around the top of the ladder.—*William Swallow, Brooklyn, N.Y.*

▶▶▶ You can avoid smudging painted lines when you use a straightedge by taping pennies to the underside. They will hold the guide off the work and prevent running.—*P. G. Wright, Foley Beach, S.C.*

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Rochester 4, N.Y.

Now, from Kodak, an automatic 35mm camera that gives you perfectly exposed black-and-white or full-color pictures—*every time!*

Wherever your hobby interests take you—in sunlight, in shade, or indoors—the needle-sharp lens of the Kodak Automatic 35 Camera adjusts itself *automatically* to the light. To focus, you simply make a click-stop setting for Close-ups, Groups, or Scenes. When you like what you see in the bright, parallax-coded viewfinder—you're ready to shoot!

For flash shots... or special effects... you simply switch to manual control. This lets you override the automatic settings, use any EVS setting you choose.

Ask your photo dealer to show you the many other deluxe features of this superb automatic camera... its projected-frame viewfinder with *automatic* "Manual" and "Low-light" signals... *automatic* leader wind-off for fast loading... thumb-lever film advance that *automatically* cocks the shutter... *automatic* frame counter and double-exposure prevention.

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Short Cuts and Tips

FROM PS READERS

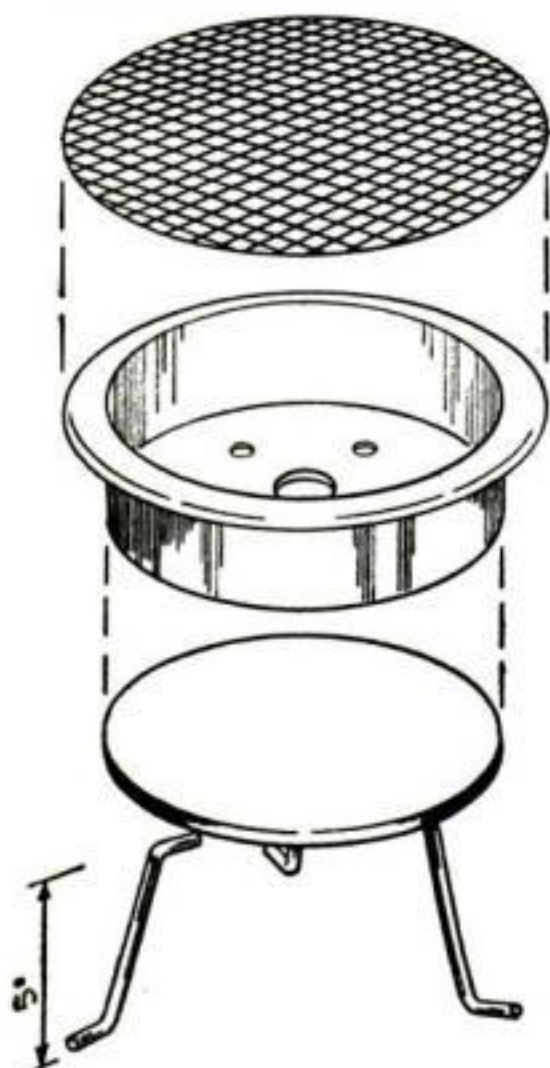
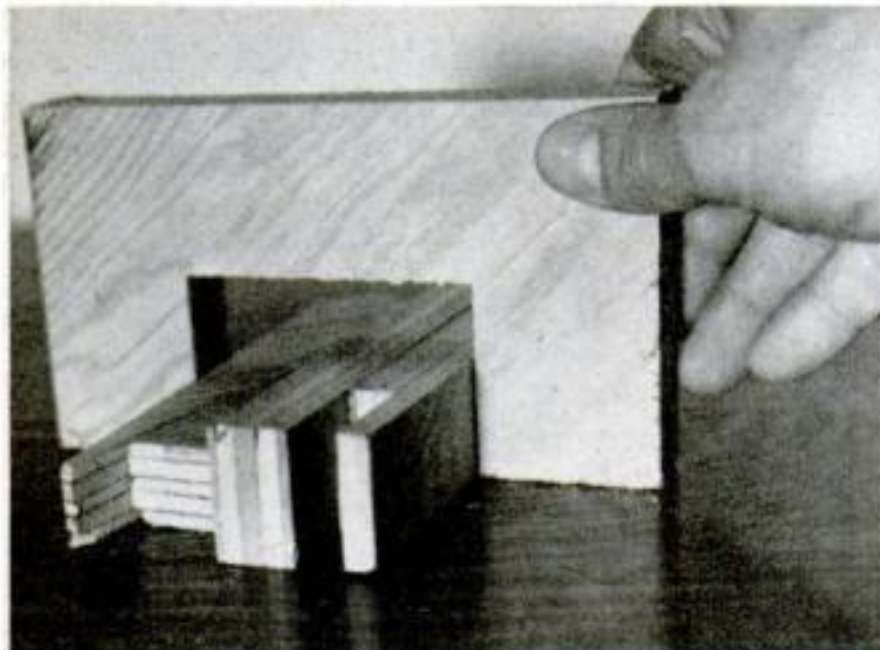


Table-Top Brazier for Picnic Suppers

HERE is a charcoal burner you can use over a heat-resistant pad right on the table without marring the finish. It is made from an old brake drum of the kind you can pick up for a few cents at an auto junk yard.

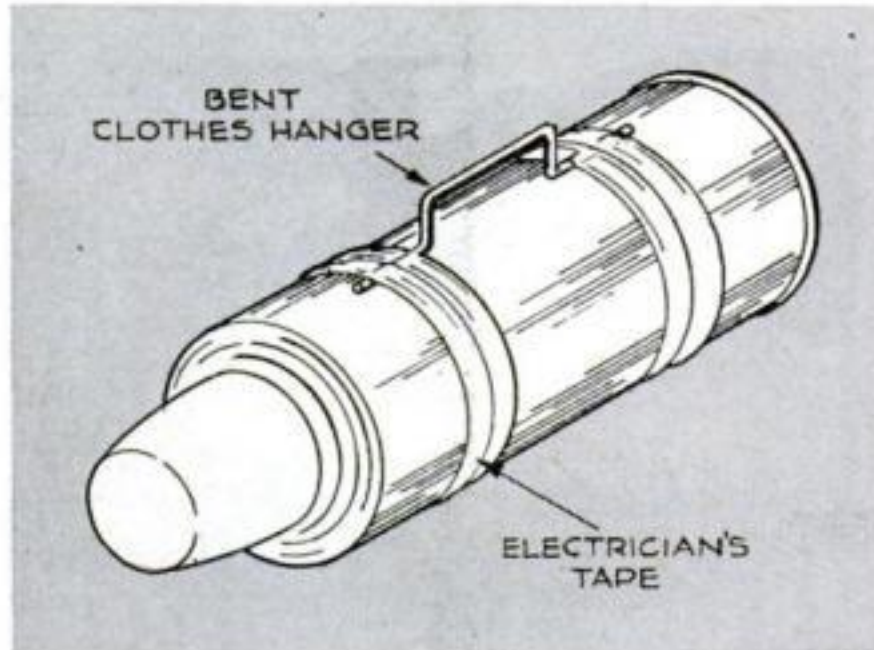
Weld a steel plate to the outside to close the holes and weld on three legs bent from 9" lengths of $\frac{1}{2}$ " rod. The grill is cut from expanded metal lath. Finish by blacking the drum with stove polish and painting the legs with stovepipe enamel.—*Hi Sibley, Nuevo, Cal.*



C Clamp Made from Plywood

TRY using a C-shaped piece cut from scrap plywood, and you'll find it makes an excellent clamp for a small gluing job. Cut the opening to fit over the work and tap in a pair of wedges to apply pressure.—*R. Mathiot, Lake Grove, Ore.*

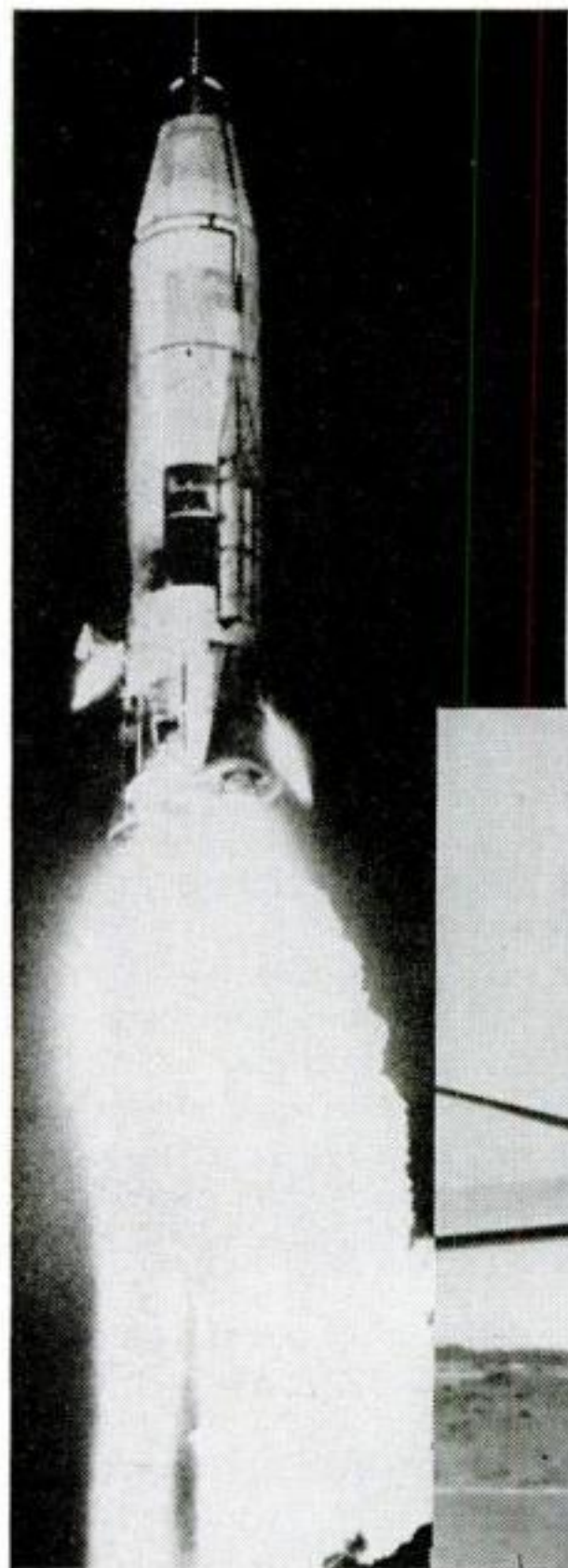
▶▶▶ONE plumber includes two large cellulose sponges in his toolbox and uses them for mopping up water spilled on the floor. He keeps them in a plastic bag to prevent rust on the tools in his box.—*Arthur R. Tanner, Poughkeepsie, N.Y.*



Carrying Handle for Vacuum

MY VACUUM bottle is too big to fit in my lunchbox, so I made a handle for it out of clothes-hanger wire. I bent the wire to shape and attached it with electrician's tape. It makes carrying easier.—*Ronald D. Wheeler, North Las Vegas, Nev.*

▶▶▶How many persons think to keep several dimes in a first-aid kit carried in the car's glove compartment? The time could come when they would be useful for phoning a doctor from an accident scene.—*Leonard E. Knight, Compton, Cal.*



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More for the money... big, generous 16-oz. can... 1/3 more than average 12-oz. can. And the beauty lasts!



Better Things for Better Living
...through Chemistry



Detroit Report

[Continued from page 48]

battery-powered automobile is being prepared in Ohio.

The Cleveland Vehicle Company expects to have its electric car out of the prototype stage early this summer. It's slated to have a glass-fiber body, tubular-steel chassis and a new, lighter lead-acid battery developed by Electric Storage Battery Company. Claims include cent-a-mile running costs, 100-mile range. Price target: under \$2,000.

And American Motors has announced a joint project with Sonotone Corp. to develop an electric auto powered by a nickel-cadmium battery that would be constantly recharged by a small, high-performance gasoline engine.

A chemical fuel additive that works with tetra-ethyl lead to increase gasoline octane ratings has been discovered by Texaco scientists. Described as a "tetra-ethyl lead appreciator," it will raise 100-octane gas about one number.

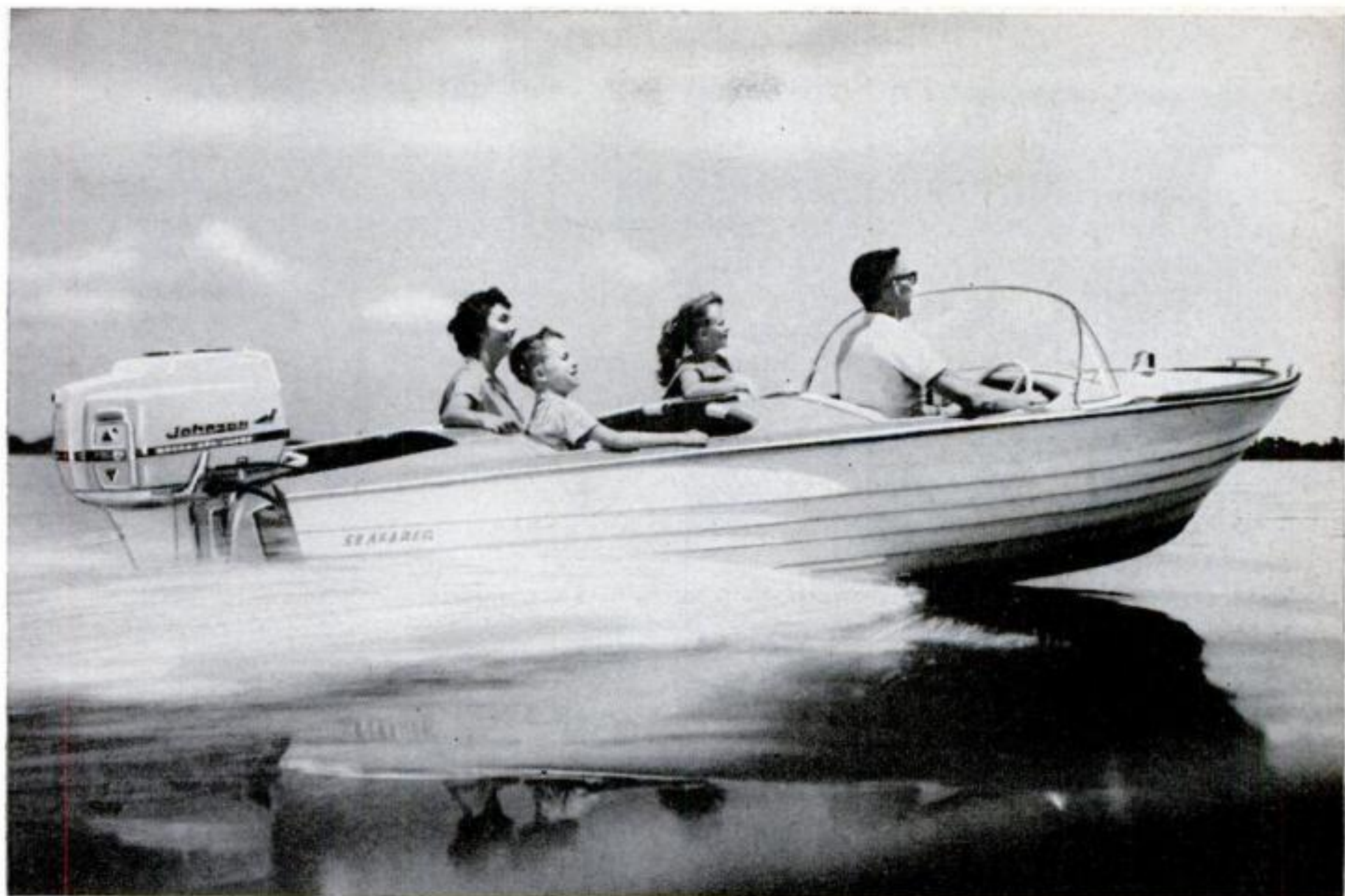
Initially, it won't be used to raise octane above present ratings, but since its effect increases as octane rises—it jumps 106-octane gas to 108 or 108.5—it could pave the way for higher compression ratios in the future.

An unchoosy six-cylinder engine has been developed by Continental Motors in cooperation with Army engineers. It runs on a variety of fuels—including No. 1 and No. 2 diesel fuel, kerosene, turbine fuel and gasoline. Different cylinder heads do the trick.

The 1960 models to be announced this fall will make wider use of unitized body-frame construction—and not just because new Big Three compact cars are expected to be built this way.

Chrysler's plans to switch to modified unit construction for its larger cars were verified when one of its major frame suppliers warned employees it may have to suspend operations late this summer. The company, Midland-Ross, has been supplying frames to Chrysler for years.

De Soto made a point of telling its dealers recently that it plans to invest nearly \$25 million in engineering and styling new models during the next few



Super Sea-Horse V-50... a new dimension in outboard power!

Why outboarding actually “feels” different with the Sea-Horse “V”!

It will happen a hundred times this very weekend. There will be a small crowd gathered at dockside where a boat with a sleek, white motor is tied up. Someone's about to try a V-50 Sea-Horse for the first time.

He steps aboard, slips behind the wheel and kicks her over with just a twist of the ignition key. Then, with all lines free, he shifts into forward gear and eases open the throttle.

Right about now you'll see a smile break out on his face—a smile that widens into a man-sized grin as he opens her up out on the water. After this ride, no other outboard will ever feel the same again!

What is there about this new Sea-Horse V-50 that makes it so excitingly different, so much fun to handle?

Let's start at the starting. Here's the first difference you feel. It's Johnson's new electric starting motor that makes the V-50 spring to life so eagerly. This is a more powerful motor

than ever before, yet it actually uses less battery current than older types.

And that velvety-smooth idling. That's Johnson's thermostat-controlled cooling at work. It quickly brings engine head temperature to a perfect 140°—and holds it there automatically, regardless of outside water temperature.

That wonderful surge of power responding to the throttle is something you'll feel only in a “V”. Firing impulses come every 90°, feeding a beautifully balanced flow of power through the short, rigid crankshaft. You get full thrust instantly . . . full horsepower at just 4500 r.p.m. And this is real, load-lugging power. There's a mighty 70.7 cubic inch displacement at the heart of the V-50.

These are just a few of the things that will make Johnson's new V-50 a completely new experience in boating for you. To get the whole story, see your Sea-Horse dealer. He's listed under “Outboard Motors” in the Yellow Pages.

 **Johnson** FIRST IN SALES
FIRST IN DEPENDABILITY

JUNE 1959 197

Detroit Report: U. S. Small Cars Coming Fast

years. The announcement was calculated to silence rumors that De Sotos might be dropped from the Chrysler line.

Experiments with cerametallics

for use in gas-turbine engines by Ford's Scientific Laboratory may have the side result of revolutionizing cutting tools.

The original goal was to find materials for turbine blades capable of withstanding high temperatures and high speeds. A titanium carbide with excellent properties for use in cutting tools was uncovered during the project. It has given seven times the life of tungsten carbide tools.

Those transaxle rumors—that they would appear on some 1960 General Motors models—appear to be wrong. It's no secret GM has been working for some time on moving transmissions to the rear, to reduce tunnel height. Target date reportedly was this fall; word now is that it has been shoved back at least a year.

More swivel-seated cars are due this fall. Ford is set to offer pivoting

front seats as optional equipment. Some GM divisions may follow suit. Easing exit-entrance problems, the seats have been well received in '59 Chrysler cars.

Owners of Studebaker Larks with six-cylinder engines who feel their cars have too much body lean on corners will be happy to learn that the front stabilizer bars used on eight-cylinder models are available as optional equipment for sixes. They cause a slightly firmer ride, but improve handling noticeably.

Positive valve actuation that doesn't depend solely on springs to return valves to their seats is being studied by Ford engineers. Pioneered by Mercedes Benz in its "desmodromic" valve engines, it uses camshaft-operated mechanical fingers to move intake and exhaust valves down as well as up. Advantages include lessened camshaft wear, less trouble from mismatched springs, and potentially higher engine speeds. The latter would be especially important in smaller-than-current engines.

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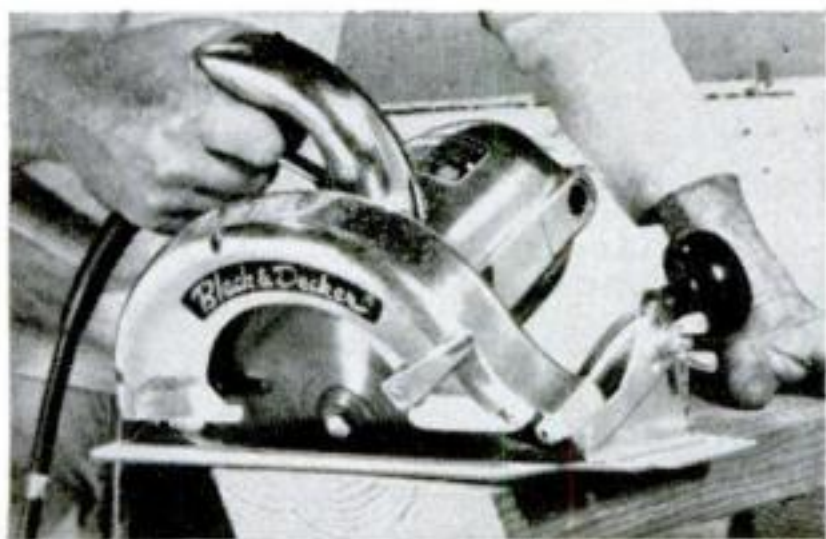


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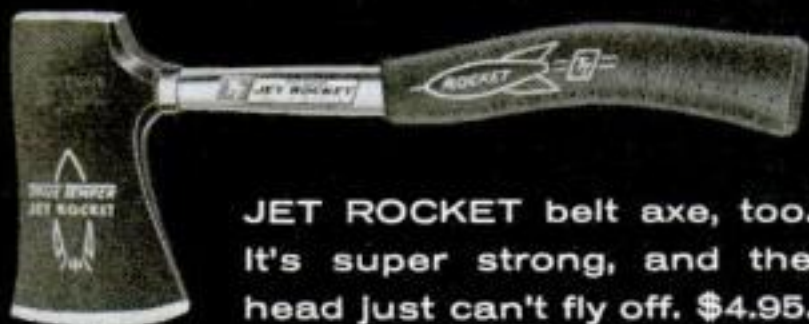
JUNE 1959 199



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TRUE TEMPER®

THE RIGHT TOOL FOR THE RIGHT JOB

Making It Tougher for Smugglers

[Continued from page 63]

or on—or even inside—people. But their best tool is a well-developed knowledge of human behavior.

How smugglers shape up. Nearly everyone looks self-conscious and embarrassed when undergoing customs inspection, but the person trying to prevent a careful hunt usually exposes his guilty conscience, even if he's not fidgety. He may be overly friendly and too talkative, inspectors say, or he may act reluctant to talk at all, or be a shade too protective of one particular bag. Or he may try to tip an inspector for not having been suspicious. This last is the worst mistake a smuggler can make. It invariably inspires the customs man to start all over, this time with agonizing thoroughness.

Inspectors are taught to look for little incongruities in a person's appearance. When tall girls wear high heels or thick soles, for instance, the customs men have found they often deserve close scrutiny. One such lass arrived with \$200,000 worth of diamonds in her shoes.

Some inspectors have a shrewd way of comparing the size of a passenger's neck with the size of his waist. Scrawny necks and bulging girths very seldom go together naturally. If an individual with both appears in the inspection line, the chances are that something he is trying to hide from the inspector is making him abnormally bulky around the middle.

Sensitive depth perception. A casual test with the fingers of one hand will tell an experienced inspector whether or not the interior of a suitcase is too shallow for the size of its exterior. If it seems to be, the suitcase probably has a false bottom, so his fingers explore further, pushing to see if the lining has unusual "give" to it, rapping it to find out if it has a hollow sound. This technique, used regularly on trunks and hand luggage, has often led to the discovery of valuable caches of jewelry and narcotics.

In New York, it once led to one of the strangest finds in Customs history. A visitor from abroad who appeared affluent but uneasy had with him a trunk with a rather obvious false bottom. He could not speak English, so the inspector questioned him through an interpreter.

The man squirmed and protested, but finally gave the extraordinary explanation

Ever wanted to design your own car? Chevrolet lets you come awfully close—with a choice of nine engines, five transmissions, two suspension systems, regular or Positraction rear axles, special cams, solid or hydraulic valve lifters, two air-conditioning systems, even Fuel Injection. You name it, chances are Chevy has it. Here's an example of what we mean.

“I ‘built’ my Chevy as a magic carpet
...with a pure-silk cruise.”



“When I sold my business and retired I knew exactly what I wanted to do: slide behind the wheel of a big long-legged car and spend a solid year seeing the U.S.A.

“And I knew exactly the car I wanted, too, after an evening studying Chevy’s all-out list of options. Here’s my own recipe for the ideal cross-country automobile:

“An Impala convertible; the Turboglide transmission* (so *completely* automatic it takes the strain out of strange big-city traffic); and that whopping 348-cubic-inch Turbo-Thrust V8* (for the quietest pure-silk cruising I’ve ever felt in *any* car).

“Just to make it a real magic carpet I added power steering*, power brakes* and that six-way

power seat*. Say, I’d pay double for that; on a long stretch you change positions a couple of times and you just don’t get leg cramps or tired shoulder muscles! One thing I can tell you after putting 20,000 miles on my Impala, I’m tickled pink with the car Chevy let me design for myself—there’s just nothing like it!”

Well, that’s the reason behind Chevrolet’s terrific range of options—nothing’s quite so satisfying as a car “tailor-made” to your needs. And we’re darn sure that, whatever you want, there’s a Chevy to fit your dreams. Try us and see. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

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Making It Tougher for Smugglers

that there was nothing hidden in the trunk but his lady love's pillow. Romantically, he had intended to rest his own head on it in this country until she could join him. But he had heard that certain nations forbade the importation of feathers, so he was playing it safe.

The inspector didn't believe this story for an instant, so he summoned a carpenter to uproot the partition in the bottom of the trunk. There was a pillow, all right, so he proceeded to rip it apart, anticipating hidden treasure. But there was nothing in it but feathers—just feathers—and both he and the dejected visitor were left feeling mighty foolish.

The informers. Customs men admit that most of their biggest hauls are made as a result of tips from informers, recruited abroad. These tipsters often work for well-known jewelry houses, diamond merchants, exporters or celebrated dress designers. Whenever an American tourist makes a purchase of unusual value in any of those places, an informer is quick to pass the word along to the U. S. Bureau of Customs. Its inspectors are then alerted.

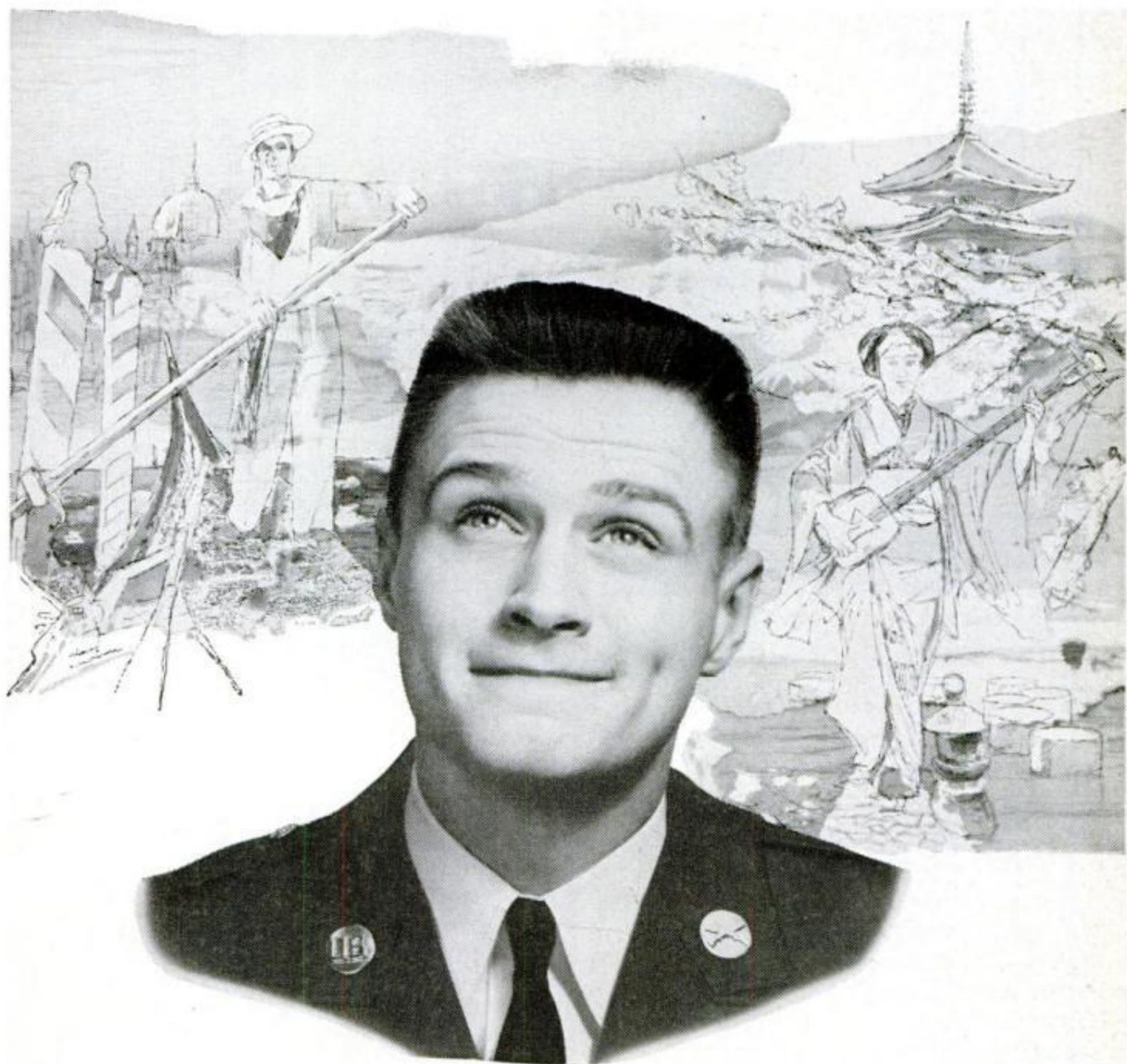
The incentive for this sort of talebearing is high. If the tourist is caught trying to smuggle in his purchase, the informer is awarded 25 percent of its value, or a maximum of \$50,000.

A wealthy woman who bought a splendid pearl necklace in Paris, with the exciting hope of sneaking it into the U. S. in the lining of a suitcase, was nabbed in the act because three people had tattled. One was the man who sold her the pearls, one was her maid, and the third was the man who built the secret compartment in her bag. The maid's report was the first to arrive, so she collected the award.

Although most professional smuggling is done by men, more women attempt smuggling than men, customs inspectors declare. This may be because they think they are less liable to be searched (not true, for there are women inspectors to do the hunting), or because they believe they are cleverer at hiding things (not true, either). But it is also an inevitable result of the fact that women buy far more things on trips abroad than men do. And often they are more anxious to conceal an extravagant purchase from their husbands than they are to deceive the customs men.

END

EUROPE...OR THE FAR EAST?



choose your travel before you enlist

Ever had the itch to travel? To explore Paris at night? To hunt wild boar in the forests of Japan? To try surfboarding at Waikiki? Skiing in the Swiss Alps? Swimming on the Italian Riviera?

Every year, thousands of American soldiers experience the thrill of foreign adventure. Roaming far-away corners of the world that most folks at home can never hope to see. Storing up exciting memories that'll last a lifetime.

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P.S.

You may enlist in the Army for only three years.

CHOICE, NOT CHANCE **U.S. ARMY**

JUNE 1959 203

Preview: Rear-Engine U.S. Small Cars

[Continued from page 54]

tempts to build a rear-engine U. S. car, but it has killed them before they were much past the experimental phase.

William Stout, a highly respected engineer, tried in the mid-1930s and again in 1946 with his Scarabs. They never got past the prototype stage. John Tjaarda of Briggs created an advanced rear-engine car, the Sterkenberg, in Detroit in the early 1930s. It later inspired the Lincoln Zephyr, but that of course had its engine up front.

In 1943, Carl Doman, then vice president and chief engineer of Air Cooled Motors (Franklin), proposed a design for a rear-engine car with about the same body space as a 1942 Ford, a 116-inch wheelbase, luggage space in front and above a flat opposed engine. It never materialized.

Last major effort was Preston Tucker's Thunderbolt shortly after World War II. Some 50 semi-handmade cars were built before financial problems and lawsuits halted operations.

Modern suspension development and engineering know-how have improved in recent years, though, and this is a factor in Chevy's decision that the handling bugaboo could be licked.

Oversteering. This occurs when a car is tail-heavy: The rear tends to swing wide in turns, producing a smaller turning radius. In extreme cases—particularly on slippery surfaces—a rear-engine car will try to swap ends. This is the opposite of what happens with current front-heavy U. S. cars, all of which understeer.

Handling problems of rear-engine cars are further complicated by the fact that they are often inclined to be unstable in crosswinds. A front-engine car is like an arrow with a weighted tip that pulls the shaft along the proper path. Arrows, or cars, with the weight at back will not fly quite as straight.

Are the problems licked? Could be. When a group headed by an engineer as sharp as Cole decides that the attractions of moving the power plant rearward warrant such a step, you can pretty well figure that it has the answers. American car buyers, barring unforeseen circumstances, will have a chance to find out for themselves this fall. **END**



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RATE OF FILTRATION	5 Min.	8 Min.	9 Min.	5 Min.
ACID-DESTROYING PROPERTIES	COMPLETE	No effect	No effect	No effect

★ From independent tests by The Carlson Laboratory.

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JUNE 1959 205



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The Amazing Electric Eel

[Continued from page 68]

is probably what most often happens to men who get in trouble with the eel, Coates thinks. They are paralyzed into immobility, and drown while they can't move.

How to fool an eel. The eel is not harmed by the electrical discharges of other eels. But it is very sensitive to them. Once a fish is kayoed, and the first eel has arrived to sample it, all the other eels anywhere around will move to the same spot. The positive charge of the first eel's head attracts them, Coates thinks; it means food.

They can be fooled, however, by a pair of electrodes put into their tank—all the eels will wind up clustered around the positive electrode.

There is one possible effect of an eel's electricity on itself, Coates thinks. It is blind, or almost. At an early age, the eyes become cloudy—covered with film.

Without eyesight, how does the eel locate its prey? The answer, found by Coates, was unexpected: by a kind of electrical "radar" system.

Working with Coates, a physicist named R. T. Cox, then of New York University and now at Johns Hopkins, went to Brazil to study the eel at home. Cox listened in to the eel's discharges with a radio headset and heard a new sound: a discharge much weaker than the killing thunderbolt. Such pulses, it was found, are sent out singly, and only while swimming or searching for food. They are about one-tenth the value of the high-voltage discharge. They are also emitted less frequently: 20 or 30 times a second, 50 times if the fish becomes excited. Their source is a second pair of organs, near the tail: the Bundles of Sachs.

These electrical impulses, encountering a possible meal, tell the eel where it is.

No one knew how the eels got their signals back until Coates, curious about some small pits around the eel's head, painted them over with lacquer. The eels so treated could find no food. The pits seem to be the receiving apparatus. Electricity, traveling at the speed of light from eel to prey and back to the eel, precisely locates the eel's next meal. The system is accurate: The eel is never confused by nearby river banks or logs.

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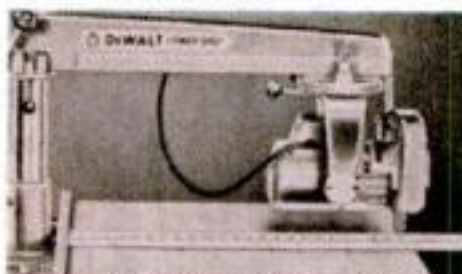
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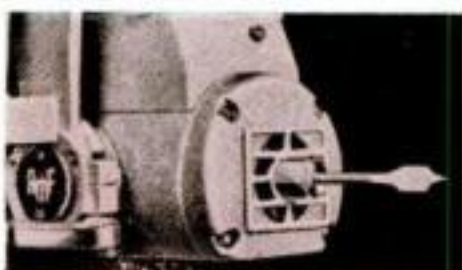
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The Amazing Electric Eel

trical organs: The Organs of Hunter. These give off an irregular discharge that seems to be related to the discharge of the Large Organs.

Unsolved problems. One thing scientists would like to know is what causes sodium ions to enter the cells of the electric organs while potassium ions leave, and thus generate the electricity of the discharge. It is believed, with much evidence, that this is caused by a chemical reaction between an enzyme called acetyl choline esterase and its substrate (the substance upon which it works) called acetyl choline. This chemical reaction takes place at the end of any message-carrying nerve.

Whatever happens, it is one of the fastest chemical reactions in the world. The major discharge of the electric eel, for that matter, is perhaps the fastest action any animal is capable of performing. It is from six to 10 times faster than the impulse speed in your own nerves.

Another thing scientists would like to know—though it isn't important electrically—is where electric eels come from: whether they're born alive, or come from eggs, or what. So far, the eel has maintained this secret. It goes off into flooded Amazon lands or Orinoco river swamps to start its family. Afterwards, a parent eel will return to the river with 50 to 500 young ones, an inch long, swimming about its head. The babies have enough electricity to tingle your fingers.

Life of leisure. Once grown, the eel has perhaps the easiest life of any animal. It lies in the mud most of the time, coming up slowly to breathe air every four minutes, and swimming languidly by means of a single long fin that undulates along its bottom side. Apparently no fish or predatory animal attacks it. Of the thousands of eels Coates has had in the Aquarium, only three or four have had their tails chewed up. Since other, non-electric eels of the same shape almost all get bitten, this is a sign that wild creatures avoid tangling with the electric eel.

The eels do fight each other sometimes. In this case, one will bite—gum—another. An electrical burn will be inflicted. The bitten eel will die—but never till the next day. How this occurs is another one of the unexplained things about the amazing electric eel.

END



photographed at Florida's Silver Springs

from 6 to 70...

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JUNE 1959 209

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PENNSYLVANIA REFINING COMPANY
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Now You Can "Fly" Your Own Outboard

[Continued from page 181]

leaves you flattened against the gunwale like a squeezed sponge.

At low speeds, these flat, skidless turns are fine for elderly grandmother-type rides; at high speeds, you have to learn a special knack.

If you crank the boat into too sharp a turn at full throttle, the sudden build-up of drag on the inner foil can occasionally cause it to stall, lose its lift and drop in.

The result is spooky. The boat "corkscrews"—rolls inward and pitches down at the same time. The sensation is similar to losing a car on ice. The horizon heads one way, the seat of your pants another, and for a brief instant nothing in the boat is nailed down.

To pull out, you do exactly as in a skidding car—flip the wheel in the opposite direction from the turn. This speeds up the inside foil, increasing its lift so that it climbs back up.

The right way. The trick, I finally learned, is to back off on the throttle going into a turn, then open her up. This allows you to speed up in the turn, instead of slowing down, so you can keep the inner foil traveling fast enough to prevent its stalling. It also induces a slight bank that helps to offset the centrifugal side thrust.

With practice, you can virtually stand on the inside foil and pivot. Steering is so precise that you can thread the needle between buoys set only a boat's width apart.

Half-size boat, full-size thrills. The Roberts foils, which I tried on a tiny 8' pram, give you all the thrills of scampering over two-foot whitecaps in a flying bathtub.

Though simpler than the Dynamics foils, their handling and stability are remarkably similar. You can sit on either gunwale, even get up and walk around.

Main difference between the two types of foils is in the load they'll support and the weight of the boat you put them on.

Dynamics' foils will lift any combination of boat, motor and passengers that adds up to a gross load of about 1,400 pounds. This means hulls weighing 200 to 400 pounds, with up to four passengers.

For most boats, Dynamics does not recommend motors of much beyond 35



WHAT DOES THIS GRILLE SIGNIFY?

➤ This grille performs a vital function by admitting an unrestricted flow of air to the radiator. It's an attractive grille by virtue of its entirely functional shape and it signifies what other grilles do not . . . that this is an honest car dealing in fundamentals.

➤ The Lark has an unusually high brake lining to weight ratio, and employs an advanced suspension system using variable rate coil springs and hydraulic shocks. Only 14½ feet long, it seats six comfortably and is extremely maneuverable, very easy to park and agile in traffic.

➤ Like to work on your own car? The Lark's engine ("6" or V-8) is easily accessible. ➤ Like economy? The Lark V-8 outclassed all V-8's in the Mobilgas Economy Run: 22.28 miles per gallon with automatic transmission. And the "6" does better. ➤ Like performance? Try The Lark V-8 with 4-barrel carburetor and dual exhausts. ➤ Like to drive? Get into a Lark. ➤ See your Studebaker Dealer.

THE **LARK** [➤] BY STUDEBAKER

JUNE 1959 211



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FREE BOOKLET "How to Save Money When Painting Your House"

Ask your Sherwin-Williams Dealer for a copy, or write The Sherwin-Williams Co., Dept. L, Cleveland 1, Ohio.

Now You Can "Fly" Your Own Outboard hp. The reason? More horses won't haul you any faster anyway. Above about 42 m.p.h., the foils begin to "cavitate." Pressure drops so low that the water boils, and the bubbles kill off the foils' lift. While foils can be made to cavitate at higher speeds—and may be offered later—designers are playing it safe for now.

The Roberts foils will support up to 800 pounds. On the 8' pram, they'll climb at five or six m.p.h. and hit up to 20 m.p.h. with a five-hp. engine. With 7½- and 10-hp. engines, you'll get speeds to 30 m.p.h. and over.

How much faster? Grumman conservatively rates its foils 25 to 50 percent faster than a boat without foils. The Roberts foils may almost double a boat's speed.

No wonder. The fastest Gold Cup hydros have a drag factor, called L/D, of about eight (the *higher* the number, the *lower* the drag). Foil-borne boats have drag factors up to 15—half the drag of the fastest water-borne hulls.

Not for cowboys. The temptation to stunt-fly foils will be hard to resist. This is all right out in the open, but in crowded waters, the foils' almost razor-sharp edges could mean sudden death to an unseen swimmer.

Jim Hartley, who designed the foil system used by Roberts, stresses the importance of using good judgment around docks and close to shore and operating at high speeds only in clear waters away from swimmers.

What will they cost? The Dynamics foil kit will sell for about \$395, the Roberts between \$150 and \$200. Roberts will also sell you their 8' pram, ready-equipped with foils, for about \$460.

Installation requires care, but is not difficult and can be done entirely with hand tools. The Roberts foils are held on by only eight bolts. Grumman's are trickier. Neither type is a one-evening project, but should be managed nicely in a weekend or two. Both kits come with assembly instructions.

Though not cheap, hydrofoils must be judged by their greater speed and maneuverability, the promise of cost savings in power and—perhaps most important—by the utterly elusive quality of winging over water in a way that makes you feel not quite earth-bound any more. **END**

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JUNE 1959 213

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What Happens When You Get Mad [Continued from page 102]

introspection. With men showing Severe Anxiety, the mother looms prominently in authority, the father being often a mild Casper Milquetoast or absent.

Practical applications of some of the Funkenstein findings would seem to be infinite. For example, Dr. Fred Elmadjian, of the Worcester (Mass.) Foundation for Experimental Biology, tested members of the Boston Bruins' Hockey team in eight straight games. Analyzing the players' urine, the scientist could tell—by the pouring out of nor-epinephrine (the Anger-Out type)—which ones were most likely to get into fights.

Who blows up?

What sort of people tend to be hot-tempered? The other day at his office in the Boston Psychopathic Hospital, Dr. Funkenstein elaborated on what he has learned from his researches.

"The higher up you go in the social scale," he says, "the greater the tendency to turn anger inward and become depressed instead of furious. A highly educated man may restrain his anger but a truck driver may punch someone's nose."

Women fly into a rage about half as often as men do. That may be because men are more constantly exposed to situations and people likely to irritate them. According to Dr. Funkenstein, however, it's due to the fact that women as a group are usually further up in the social scale than men. "They're more civilized," he says. "They don't go out and fight wars. They want to preserve the human race."

Are redheads hot-tempered? Evidently that's a myth. Dr. Funkenstein doubts if they are any more inflammable than anyone else. Maybe they tend to live up to what the public believes about them. It's true, however, that people in certain jobs—watchmakers, artists, opera stars—whose work requires utmost precision or whose egotism is easily wounded seem likely to have explosive tempers.

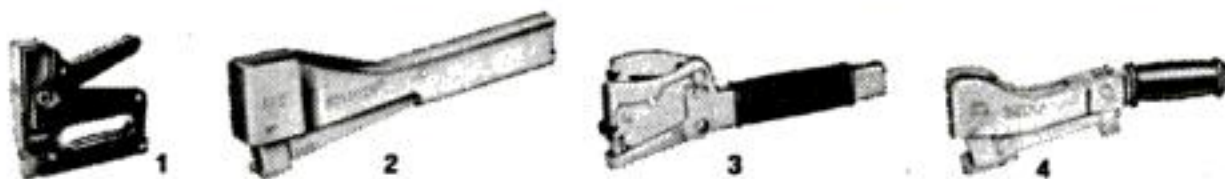
How to handle your anger

What's the safe way to treat your anger? Generally, it's best to blow off steam rather than keep it bottled up too long. Temper is an outlet to rid your system



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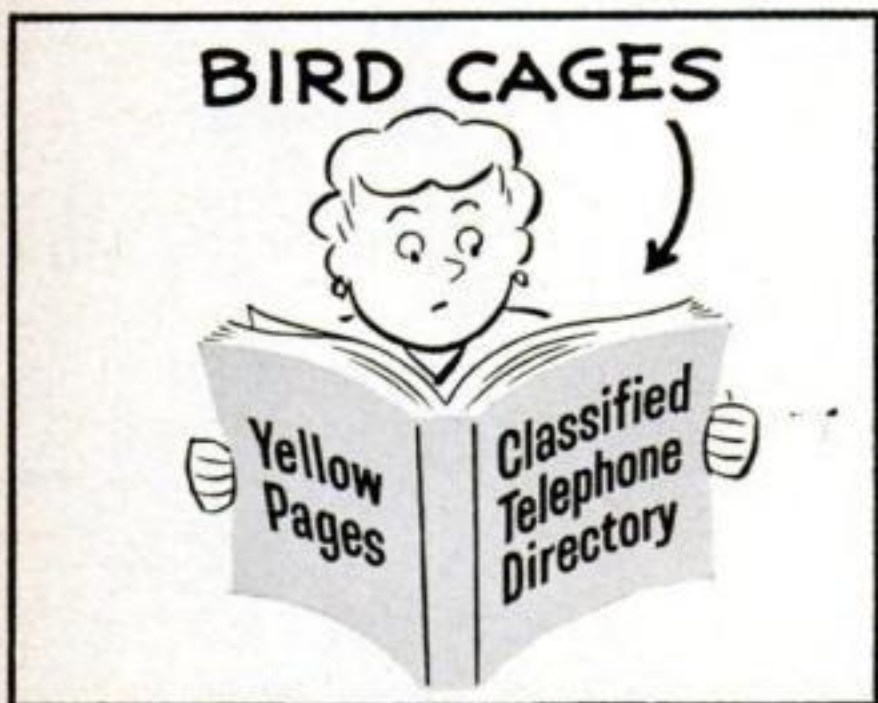
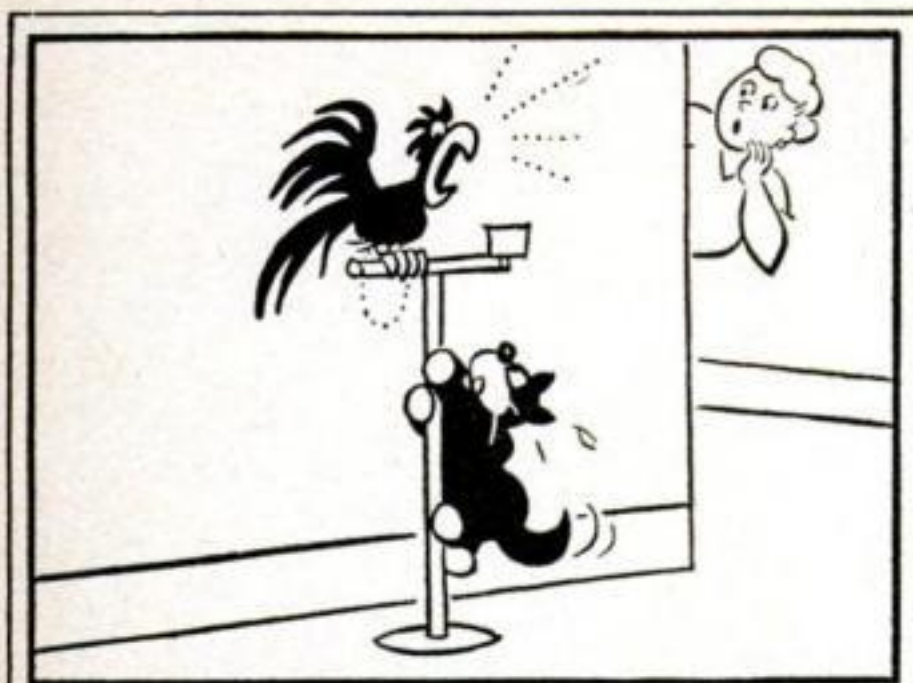
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What Happens When You Get Mad

of hates, grudges and envy. Suppressed anger only builds up health-sapping tensions. But, while it's good to valve off pressure, you obviously shouldn't go around displaying senseless rages.

The familiar device of slowly counting to 10 has value as a quick remedy. It distracts you long enough to take the edge off your temper and allows you to cool off while you consider what's really behind your fury. But, as Dr. Funkenstein points out, the trick is superficial; the roots of your anger are probably deeply laid down.

Certainly you shouldn't vent your spleen on your boss to the risk of being fired. Nor is it wise to let your anger out on your family or other innocent victims. The key to control is what Dr. McLean calls a "healthy conversion of anger." He tells of a young engineer who took up tennis. "Every time I hit the ball," said the engineer, "I see my boss's face in it."

As part of the technique of setting up a straw man as target for your anger, psychiatrists recommend chopping wood, hitting golf balls, using a punching bag, taking a brisk walk. One psychologist recommends watching slapstick movies so that you can see the funny side of frustration and indignity. Dr. Harry Levinson of the Menninger Foundation urges angry people to watch boxers on television and figuratively punch one of them in the jaw every time his opponent does.

The mature way

Anger can also be a healthy emotion. The additional adrenalin released into your blood stream almost triples your energy, which can be used as reserve power to jar you out of inertia. It's our fighting instinct, a wellspring of action. It was the angry Dorothea Dix, Dr. Funkenstein reminds us, who long ago battled for humane mental hospitals. The angered Pasteur convinced his enemies he was right. General Billy Mitchell, mad at the Army, crusaded for our air force.

Anger is normal and we should expect it as part of reality. "When and how to bottle it up or discharge it," says Dr. Funkenstein, "is the dilemma of modern times. We should feel free to have emotions. And we should learn to understand and control them."

END

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more fun, more exciting and lets you enjoy every minute you're fishing from dawn till dusk . . . with more and bigger catches.

A French Invention

The secret is a scientific 'live-action' tail that had never been patented before. Developed by a French sportsman who named it VIVIF, this wonder-working 'live-action' lure is the result of years of testing all kinds of lures on all kinds of fish...and watching the fish react to each lure under water. From these studies came VIVIF, the lure that works when everything else fails. VIVIF is now being used by over 350,000 fishermen in 25 countries who rave over VIVIF.

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PHOTO PROOF!

Fish just can't resist the amazing VIVIF with its patented "Live-Action" tail! VIVIF caught this 40 lb. salmon for Mr. G. F. Coleman and 1st prize in a fishing contest.

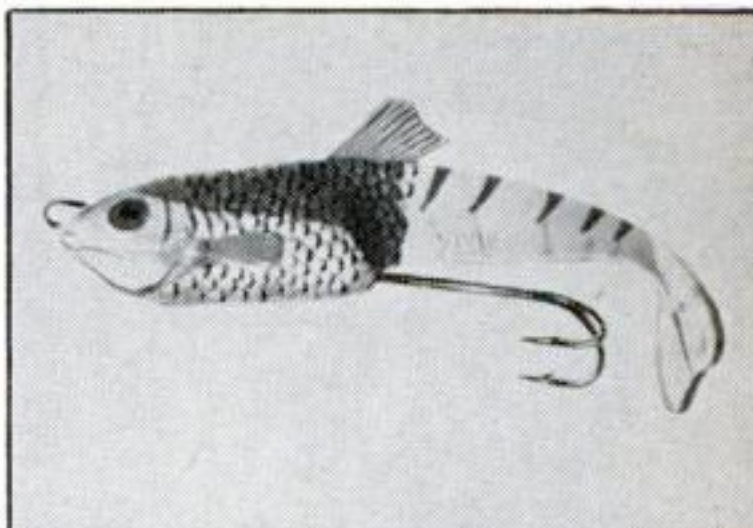
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Not just another stiff plastic or wood lure that 'looks good but doesn't work. VIVIF is made of life-like latex and is the world's most life-like lure in the water . . . works better than live bait! Color combinations have been scientifically selected by fish in actual tests. Acts and wiggles like a live minnow.

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Please send VIVIF Lures checked below for FREE TRIAL. If VIVIF does not catch more fish, bigger fish and make fishing more fun . . . you will refund my money including postage.

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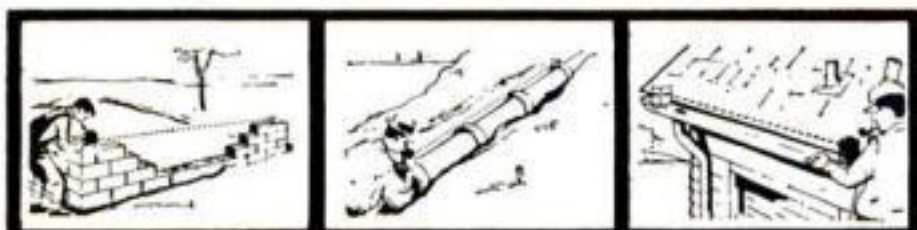
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[Continued from page 148]

load in the grinding chamber, however, the batch-feed type is more apt to jam before it gets going.

Cutter bars. You have your choice of fixed or swivel (hammermill) action. The fixed type is more prone to jamming if a hard or fibrous particle gets wedged between a bar and the outer shredder ring. On the other hand, it is faster (a few seconds on a load) and usually less noisy. In the swivel type, the bars are held in a fixed, cutting position in normal operation by centrifugal force. When an obstruction threatens, the bar pivots aside. It's supposed to snap right back. Sometimes, however, it doesn't, and the cutting action becomes less efficient.

Some disposers have a reversing switch that will clear up minor jams by spinning the flywheel momentarily in the opposite direction.

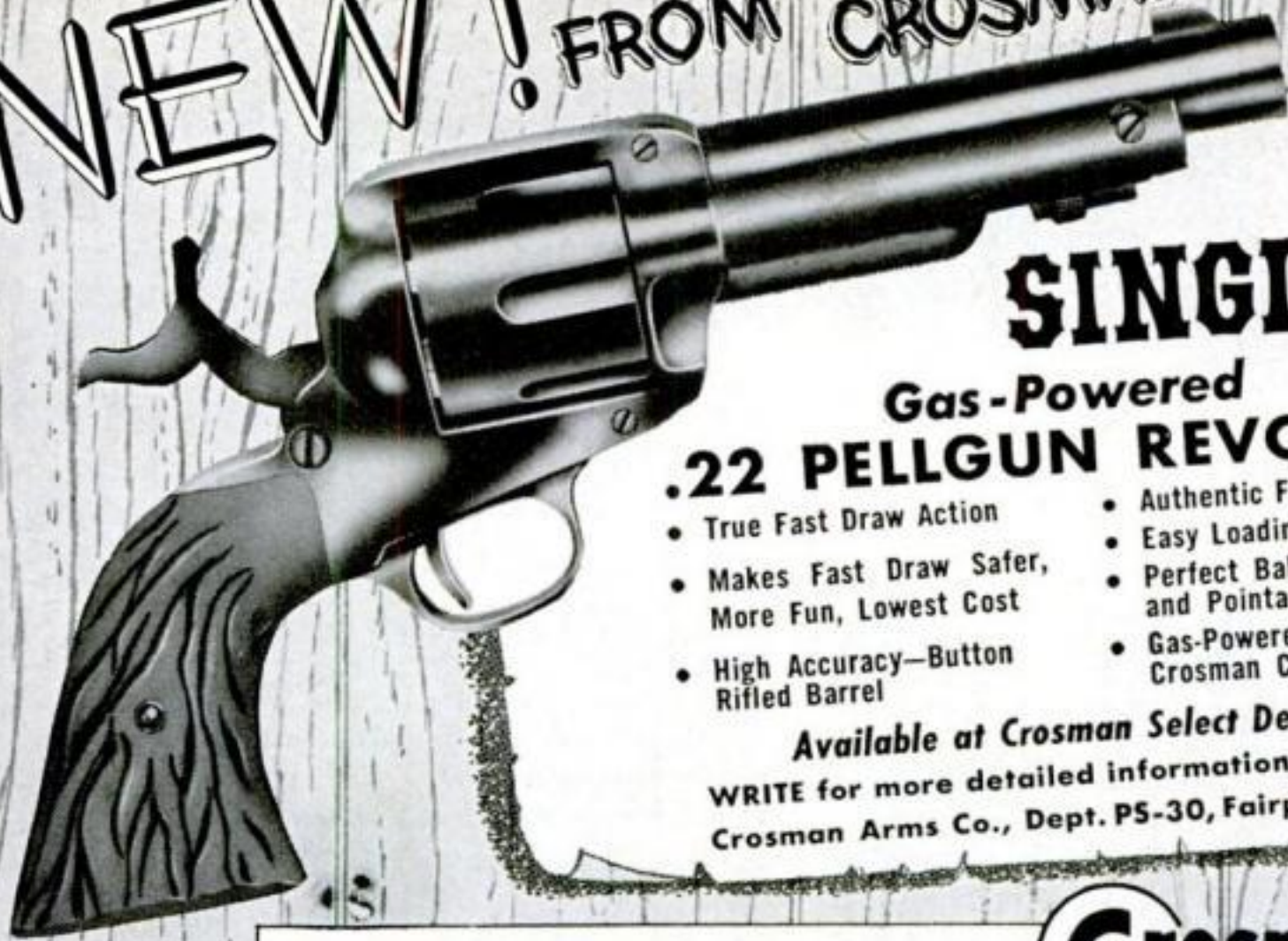
All food-waste disposers have automatic overload protection that shuts the motor off when it is worked beyond its capacity. In batch-feed units the motor restarts automatically after a short interval—as long as the cover is on. With continuous-feed types, however, the motor has to be reset manually—a safeguard so that it won't go back into operation while you have your fingers in it, trying to clear up the obstruction.

Installation. If you have confidence in yourself as an amateur plumber, you can put in a disposer yourself. Manufacturers stress that installation has been simplified in recent years, and most of them supply installation instructions. Professional installation may add \$30 or more to the cost, depending on your sink and plumbing arrangement.

Food-waste disposers are designed to fit into and under all standard-size sinks. Height and diameter dimensions for all principal units are given in the chart. A ruler will tell you if any particular unit will fit your under-sink space. The critical factor is "minimum rough-in"—distance from the underside of the sink opening to the center of the drain connection.

How noisy are they? The fact that all manufacturers of disposers point up the quietness of their products by using words such as "whisper" and "hush" indicates how conscious they are of this stigma left over from early models. One maker

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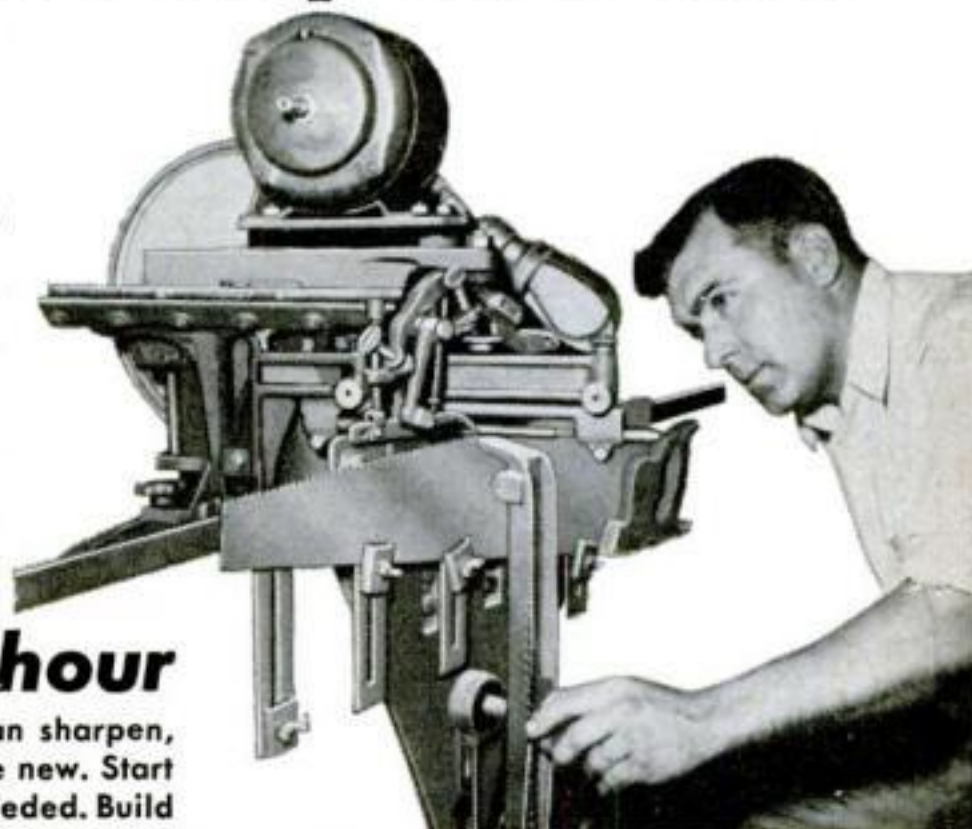
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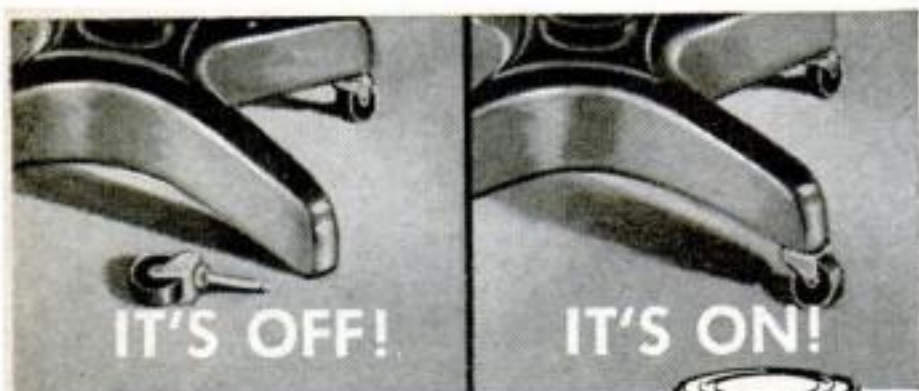
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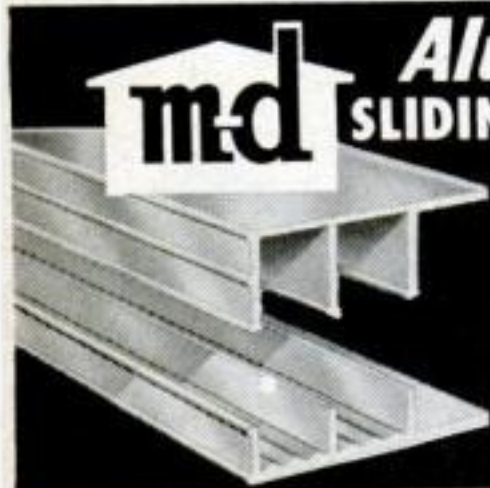
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even states proudly that ordinary conversation can be carried on in a kitchen while its garbage grinder is working.

In most new units a balanced design cuts down vibration. Rubber mountings and rubber sink and drain connections further reduce noise. Also, today's units grind faster, reducing noise duration.

Another improvement in disposers during the last 10 years is that they grind more efficiently. They take smaller bits and many more of them. This also tends to make them less noisy, and more trou-

.....

***NEXT MONTH:** A carport is the inexpensive way to shelter the family car. For a picture gallery of carport types—and a wealth of suggestions about building the one you like best—don't miss July PS.*

.....

ble-free. And because the waste is in a more liquefied state, it lessens the load when used with a septic tank.

Septic tanks. Food-waste disposers can be used satisfactorily with septic tanks—hundreds of thousands are—if the tank is big enough. It should be of at least 500-gallon liquid capacity. Waste from the disposer will not affect bacterial action, but more sludge will be collected. A tank will need more frequent cleaning unless it is large enough to handle the extra waste.

In new home construction, most manufacturers recommend that a septic tank be made 50 percent larger if a disposer is installed. This is borne out by a U.S. Department of Health publication, which states, "Where a household garbage grinder is used, more frequent cleaning will be required unless the tank is large enough to accommodate the additional wastes."

With cesspools, which do not have as efficient bacterial action as septic tanks, there is divided opinion. Several manufacturers do *not* recommend the use of disposers with cesspools. Certainly more frequent cleaning will be called for.

One advertising suggestion—that a waste disposer be regarded as an extra member of the family—may be stretching the family relationship. Before you adopt one, consult your local sanitation or health department.

END



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Mercedes: Royal Family of Cars

[Continued from page 77]

gas engines won't produce their best under 4,700 and run up as high as 6,400. The low-speed diesel is something else again, and we'll come to that in a moment.

High peak speeds mean low output at the bottom end, and that's the worst fault of the Mercedes family of cars. By U. S. standards, they're sluggish unless you crack on the revs. There's a reason, of course—das benzin (petrol to you) is dear in Europe, engines must be small for economy, and small engines have to peak high for performance at highway speeds.

The miles-per-gallon. The fuel economy, on the other hand, is excellent. Twenty miles to the gallon is about par for the course, even in stop-and-go, and a Mercedes diesel will tote 3,300 pounds—car and passengers—for an incredible 500 miles on less than 15 gallons. Volkswagen owners should blush.

The most sophisticated of the Mercedes gasoline engines are those fueled by pump injection. Two of these use "port" injection—the gas is sprayed into the intake pipes just short of the valve. A third uses direct injection—the gas goes into the cylinders through the wall.

Injection is timed for each cylinder, like the igniting spark. In this respect, the system is unlike the only passenger-car "injection" system used in this country, that for the Chevrolet Corvette. The Corvette's is more a pressure carburetor than an injection system.

Look, ma, no plugs. The Mercedes diesel, with Bosch injection, is an enticing oddment. Painfully slow on the up-beat, it peaks at 3,500 to 4,000 r.p.m. Its highest output, on a compression ratio of 21:1, is 55 horsepower, which figures out to a smidgen more than one horsepower for each two cubic inches of displacement.

And now, here's a warning to all potential diesel owners:

Some diesel drivers don't buy their fuel at a filling station. They use house furnace fuel. They can do this because a diesel will burn almost anything but cord wood or gasoline. The way you—that is, they—do this is, they buy No. 2 fuel oil for their furnaces. That's best for the car. They get a five-gallon can to transfer the fuel. The kind with the long, flexible spout is best. Then they fill it



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Mercedes: Royal Family of Cars

from the petcock on the furnace tank. In a pinch, the oil can be siphoned out. They do this because diesel fuel is heavily taxed, and furnace fuel isn't.

The warning is this: This is strictly illegal and subject to a fine.

The power transfer. There is nothing fancy about Mercedes drive trains. The most endearing piece of machinery in it is a gearshift assembly that is fully synchronized right down to and including Low.

One Mercedes, the 300d, comes with an automatic transmission. If the response to your accelerator toe feels suspiciously like a Borg-Warner lockup design introduced by Studebaker in 1950, you're dead right. It's just that.

Mercedes cars abound with controls. There are dozens on the panel, each with its own leprechaun. Just for driving lights, for example, here are the instructions in the owner's manual:

Control knob vertical (day driving)—following units operate: cigarette lighter, windshield wipers, signal horn, direction indicators, brake lights, fuel gauge, starter control light and defrosting of parked car.

Turned right to first stop—low-beam lights, tail lights, license-plate light, instrument-panel lighting (dim or bright, depending on position of pull knob), back-up light, plus all accessories listed above.

Turned right to second stop—main lights, plus above.

Turned left—clearance lights only, right or left, depending on position of changeover switch.

And oh yes, about that girl Mercedes. What really happened was this: Her old man was Emile Jellinek, consul in Nice, France, for the old Austro-Hungarian Empire. He worked both sides of the street—he also sold automobiles. He told the Daimler Motoren Gesellschaft that he would take a slew of their cars if he could name them the Mercedes. The factory liked the idea so much that it asked, may we too, please?

Benz came into the picture when the Daimler and Benz factories fused in 1926.

Judging by the picture of Mercedes Jellinek that hangs in the company's main office in Stuttgart, she was quite a doll. So are her cars.

END

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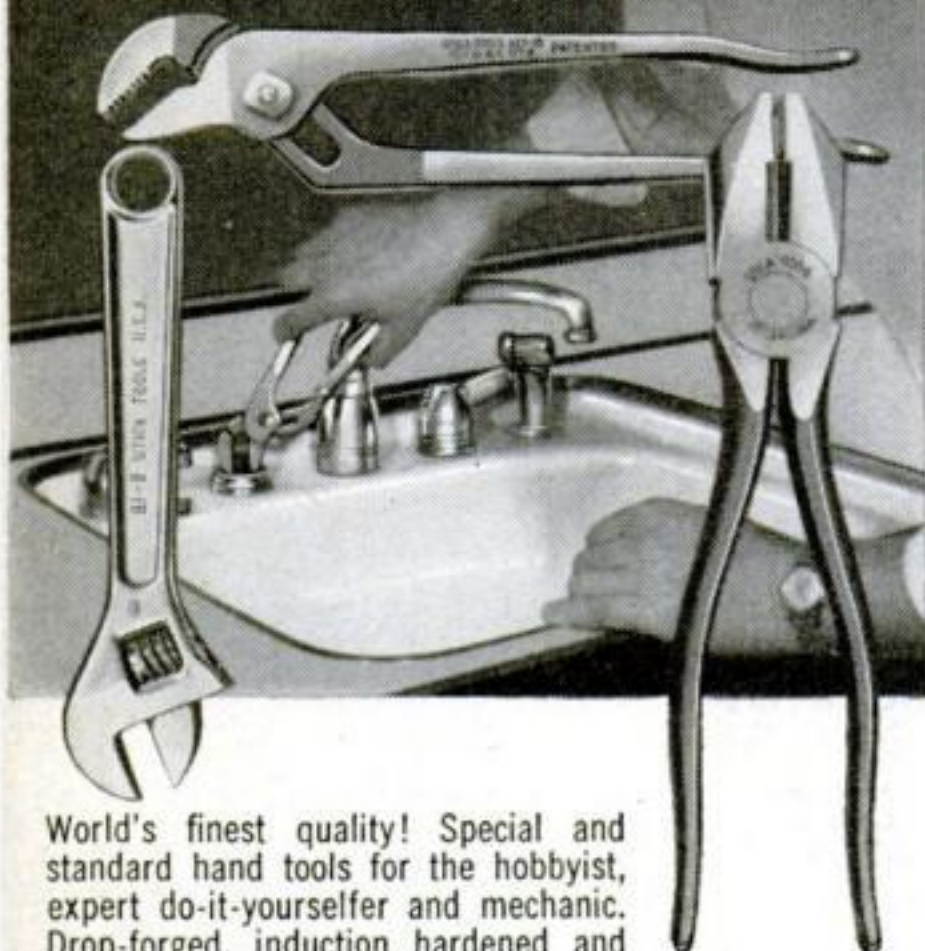
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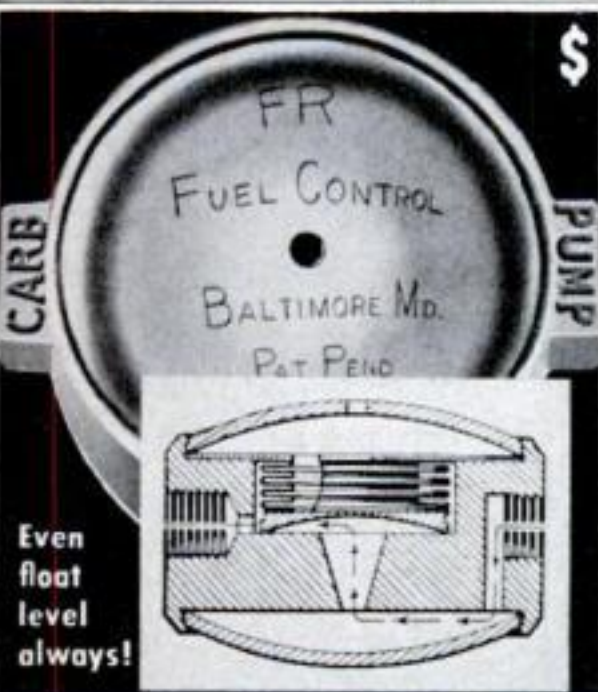
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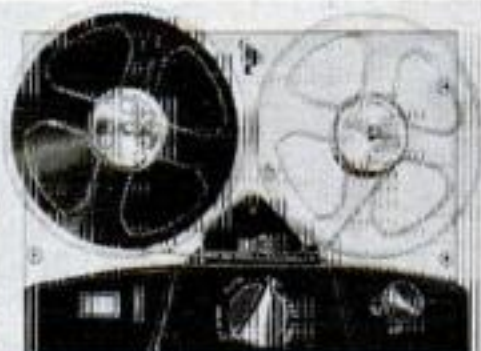
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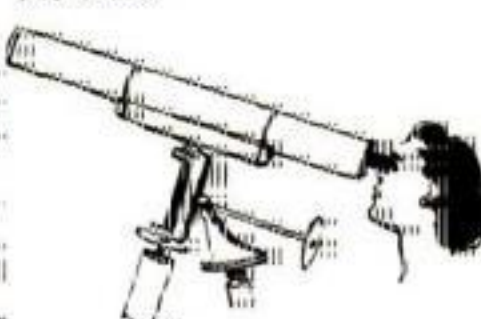
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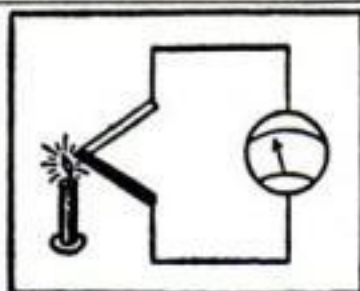
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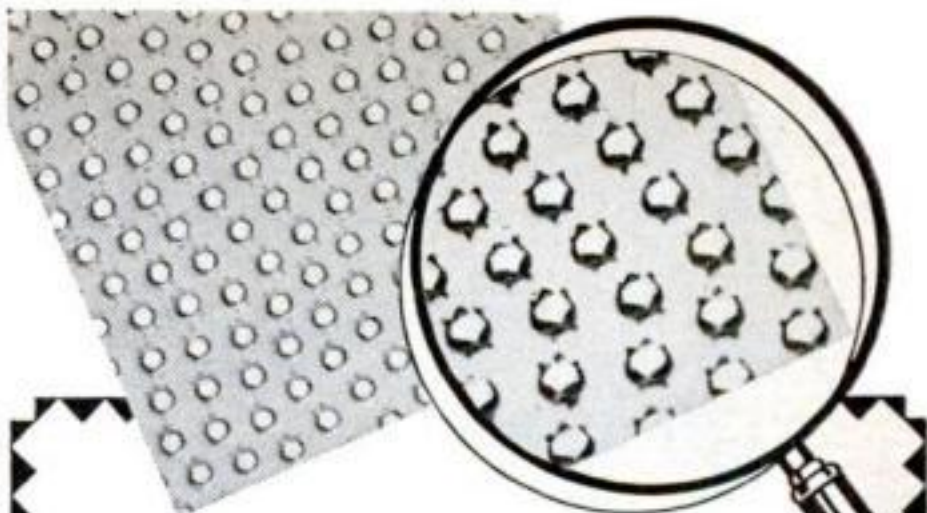
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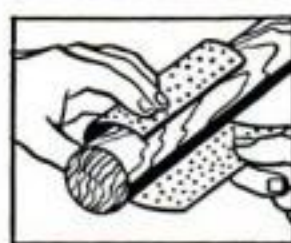
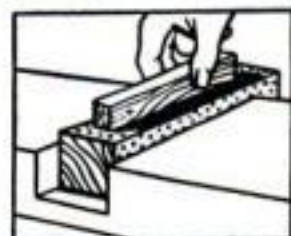
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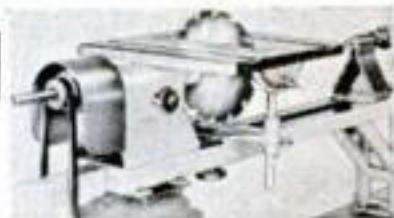
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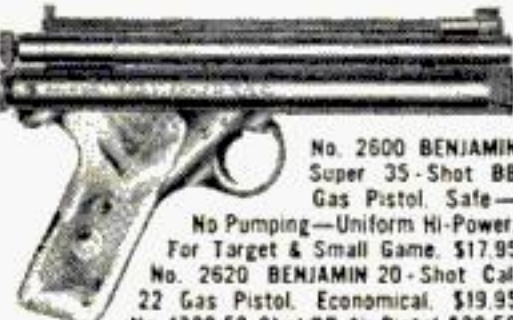
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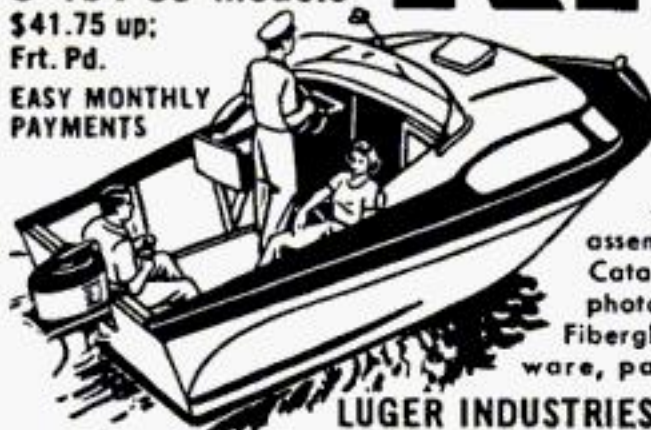
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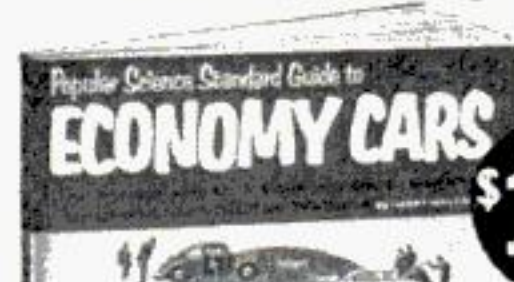
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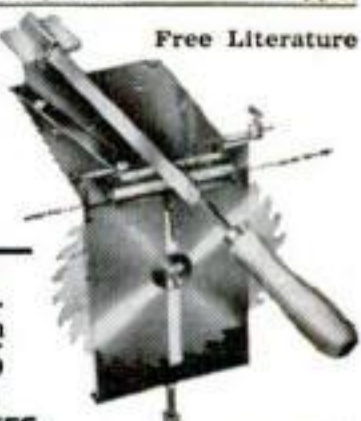
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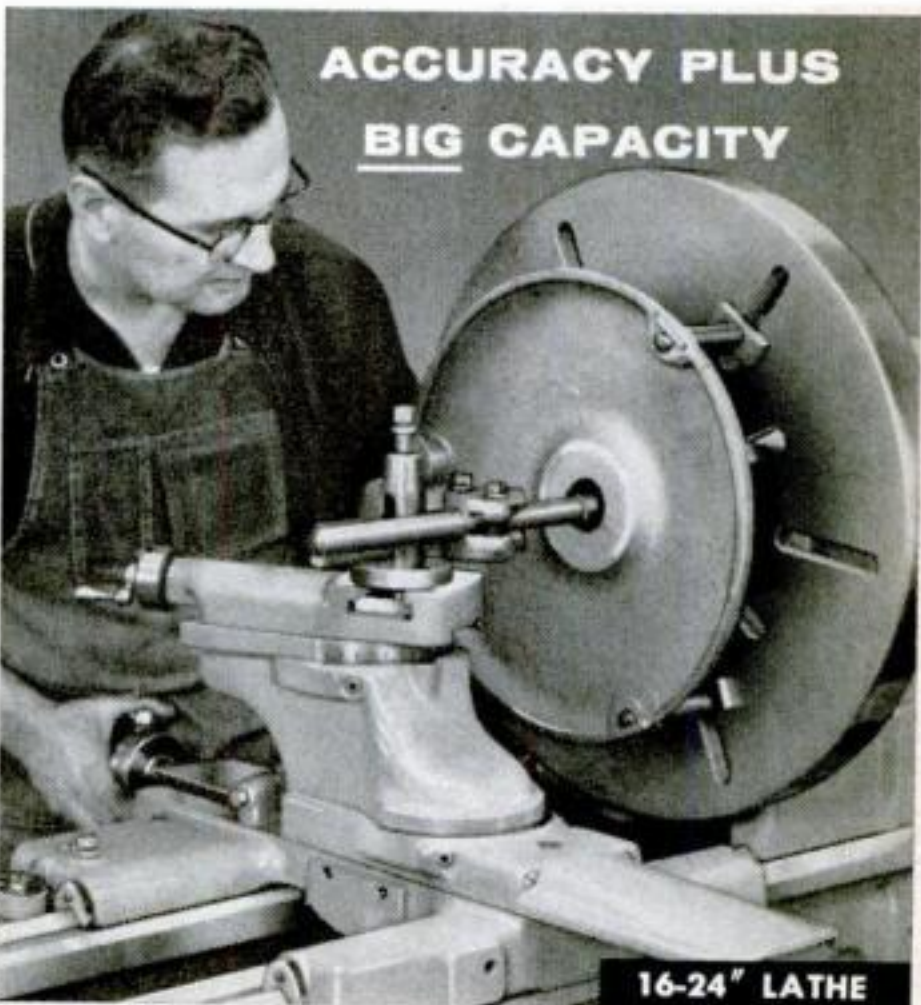
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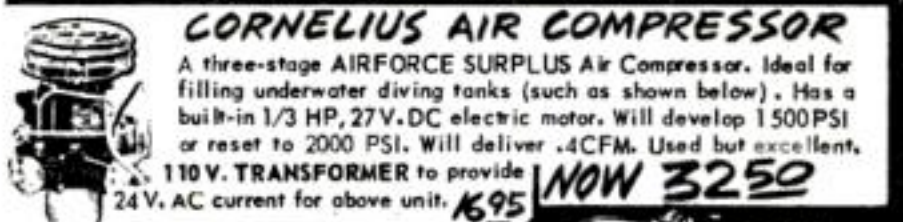
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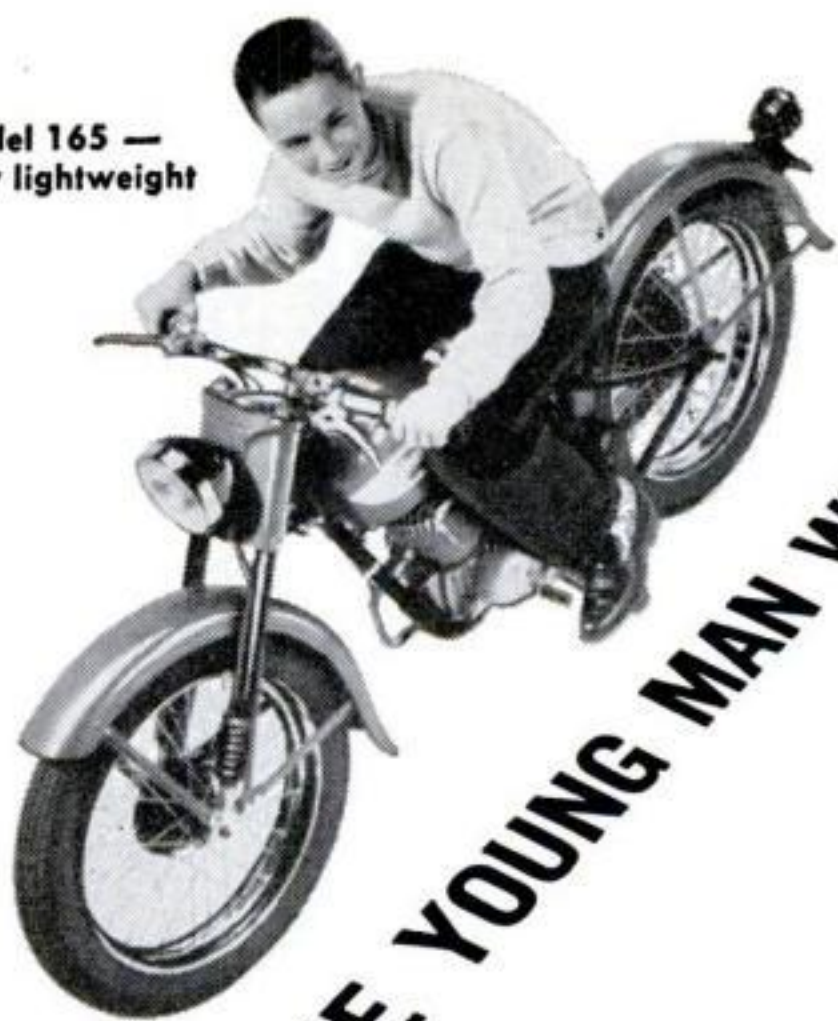


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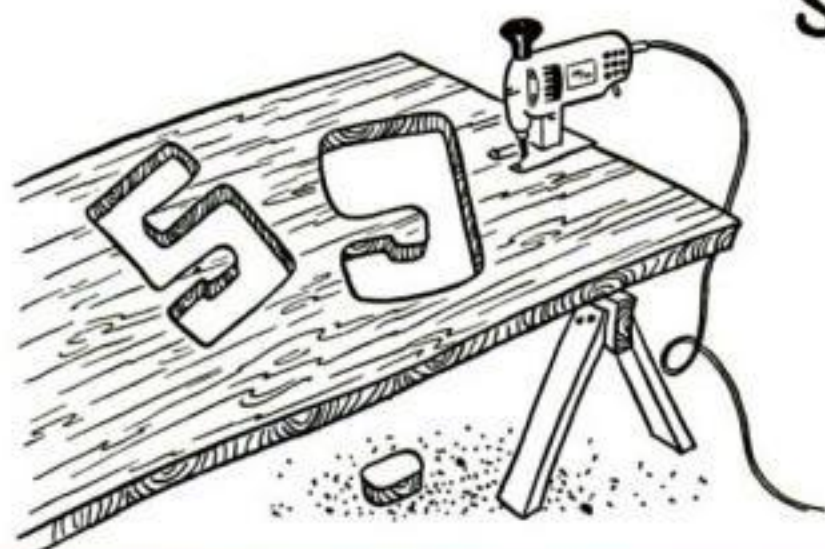
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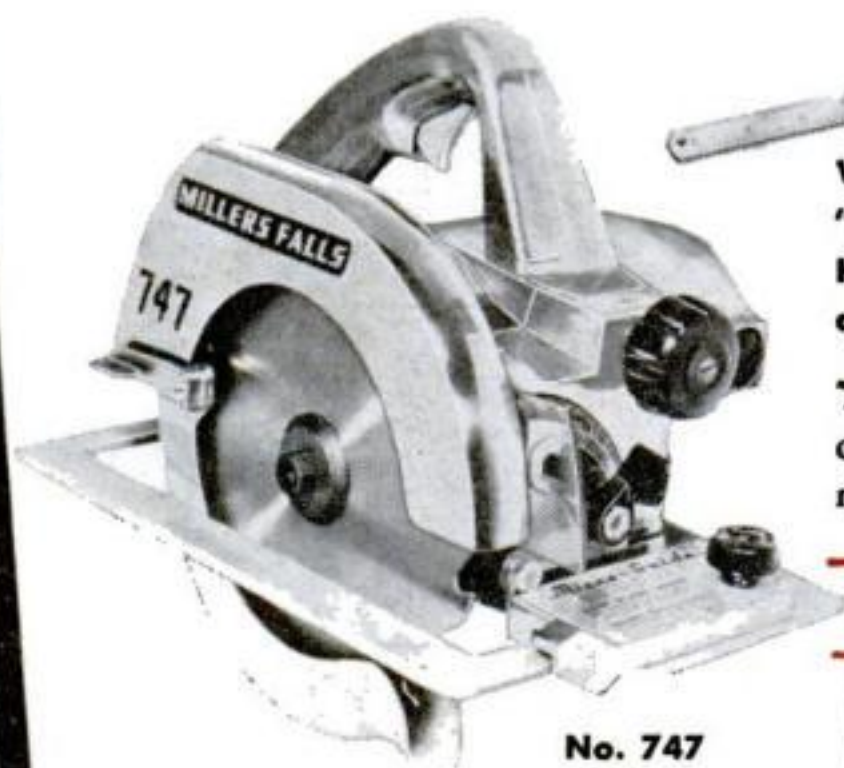
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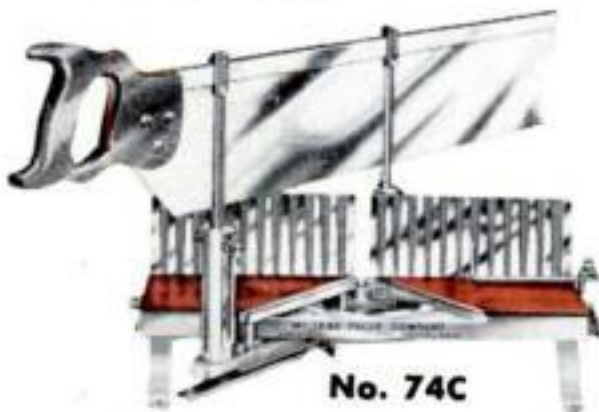
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